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The Foundry Trade Journal. AND THE IRON AND STEEL RECORD.

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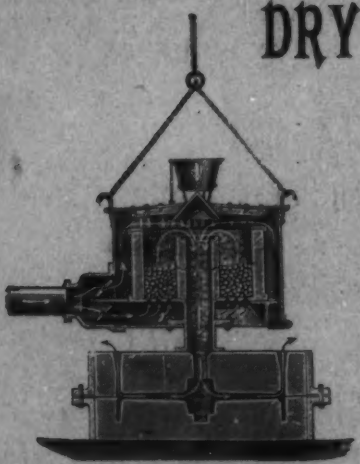

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THE FOUNDRY TRADE JOURNAL.

AND

The IRON and STEEL RECORD.

Vol. 5. APRIL 18, 1904. No. 28.

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THE OUTLOOK.

OUR FOREIGN TRADE.

OUR foreign trade cannot be regarded as in a normal condition at the present time. First, our crops in the past year were exceptionally poor, and we are consequently obliged to buy an unusually large amount of foreign grain, a fact which has tended to swell our imports. Secondly, the short supply of cotton has compelled us to buy the raw material for our Lancashire trade at unusually high prices, indeed, at abnormally high prices, and we have had to pay a larger sum than last year for a much smaller quantity. Thirdly, our exports of cotton goods have been reduced by the high price of cotton, the high price of the raw material having caused the demand for our cotton goods to diminish. The money value of the cotton goods we export has, it is true, somewhat increased compared with last year, but the quantity has decreased, and the profits which have been made by Lancashire manufacturers have been small. There are grounds for stating that the total value of our cotton-goods exports would be very much larger than it has been if our Lancashire manufacturers had been able to secure the raw cotton in adequate quantities at a reasonable level of price. Thus both our imports and our exports are at the moment affected by unusual and abnormal circumstances. Probably we shall have to wait until next year for a return to normal conditions.

On the whole, the outlook for our foreign trade is distinctly promising, although we may not feel the full effect of the new conditions until next year. India is enjoying almost unexampled prosperity, and its demands for our products, both cotton, steel, machinery, and coal, promise to show great expansion. The increased consuming power of the people and the great improvement in the economic condition of the country will enable the Indian Government greatly to add to the railway system, thereby further contributing to the welfare and prosperity of the nation, and at the same time bringing about an important expansion in the demand for British manufactured goods, such as steel rails, steel chairs, bridgework, locomotives, waggons, carriages, &c. The outlook is no less promising in South Africa. The mines are steadily resuming work, and already the output of gold is equal to about £15,000,000 per annum. In the course of the current year, with an ample supply of labour apparently assured, the output may be increased to the rate of about £18,000,000 per annum, while next year a still larger total may be attained.

This will tend to increase the traffic on the railways, and add to the demand for railway rolling stock, cause considerable expansion in the demand for machinery, and, inasmuch as labour in South Africa will be much more fully employed, there will be a greatly increased demand for clothing and other manufactures imported from this country. Moreover, the increased output of gold in South Africa will largely increase the supply of capital, stimulate enterprise, and cause many new industries to spring up. Next year, consequently, the demand for British goods for South Africa is likely to show great improvement as compared with the demand in the current year. In Australasia the termination of the drought is bringing renewed prosperity, and will stimulate the demand for our goods. In South America the outlook is not less favourable. Argentina is enjoying wonderfully abundant crops, and its prosperity is exceedingly great. Hence it is buying largely of our produce, and its purchases are likely to show great expansion. Already there is a disposition to add to its railway system, and this will mean orders for steel rails, rolling stock, etc. Beyond all these favourable factors, likely to benefit ou trade, there is the war between Russia and Japan, which has caused a great demand for shipping, and has given a fresh stimulus to our shipping industry. On the Continent also trade is reviving, and we anticipate that there will not only be less competition with British goods, but there will be a greater demand for our produce than has been witnessed since the financial crises in Germany and Russia four years ago.

Only in the United States, and possibly in Canada, are there signs of a temporary reaction from the existing great trade activity. How far the decline in trade in those countries will go will in some measure depend upon the crops of the current year. The report issued this week concerning the condition of winter wheat in the United States is decidedly unfavourable, and unless there is subsequent improvement trade may receive a further check. The maintenance of trade in Canada will in part depend upon the condition of the spring wheat crop. Concerning this crop no information is, of course, yet available; it often happens, however, that with a small winter wheat crop in the United States a large spring wheat crop is gathered on both sides of the border. There is no reason to suppose, therefore, that the trade of Canada will suffer any serious set back, especially bearing in mind the large number of immigrants into the country, and the activity with which new districts are being opened up. On the whole, therefore, there are good grounds for anticipating that our foreign trade will, when the supply of raw cotton again becomes ample, show marked expansion. Fortunately, there is the prospect that next

season the supply of raw cotton will be fully equal to the world's demands, the quantity of land now being placed under cultivation in the United States and elsewhere being very much greater than it was last year.

In the foregoing considerations we have not taken into account the great economic forces which are now making for recovery. The output of gold in the current year will undoubtedly be quite unprecedented, and it is equally certain that money will accumulate in the great monetary centres, and that we may look forward to a period of plentiful money and of capital. The effect of this cannot be felt at once, as the position created by the war, and by a period of stringent money conditions, has yet to be adjusted; but with the close of the current year the adverse circumstances which tend to prevent a recovery in trade will probably disappear. Thus it will be evident that the outlook is on the whole distinctly encouraging, and that we may in a relatively short time look forward to a marked recovery in our foreign trade, to be followed by another great growth in our home trade.

FOUNDRYMEN'S CONVENTION.

ON this page we print the report of the first meeting of foundrymen brought together with a view to establish an association to hold a convention annually. A committee has been formed, and a first president and secretary and treasurer appointed. The president is Mr. Robert Buchanan, who is well known to all of us, and than whom a more capable man for the presidential chair could not be found. He will find a sound co-adjutor and enthusiastic supporter in Mr. William Finch, the appointed secretary and treasurer. The committee is a strong one, and fairly representative of the North-East, North-West, Midlands, and South of England. We regret not to see at present a representative from Scotland, but trust that before we go to press next month we shall find not only several Scottish members, but that the committee has been largely augmented by further members from all over the kingdom, including Ireland and Wales.

It is not necessary to recapitulate the many advantages the association will be to British foundrymen, for they are well known to you all from the numerous articles and correspondence we have published on the subject. It now behoves every foundryman to at once join and give the executive their earnest and wholehearted support. This journal has from the first strenuously supported the movement, and we shall continue to do so.

Report of First Meeting.

A meeting of foundrymen in connection with the above was held at the Cobden Hotel, Birmingham, on Saturday, April 9th, 1904, when a circular to be issued to all persons interested in the Foundry business was drawn up, and the following officers were appointed:—President, Mr. Robert Buchanan, 35, Thornhill Road, Handsworth, Birmingham; Secretary and Treasurer, Mr. Wm. Finch, Kingston House, Lansdown Road, Gloucester.

The following gentlemen consented to act on the Committee, with power to add to their number:—Mr. C. Morehead, Rugby; Mr. J. Ellis, Woolston, Hants; Mr. F. C. Shaw, Birmingham; Mr. John G. Stewart, Urmston, Lancashire; Mr. F. J. Cook, Birmingham; Mr. Percy Longmuir, Sheffield; Mr. William Vickers, Birmingham.

It is sincerely hoped this first meeting of foundrymen will be the means of bringing the Convention to a successful issue, and that all foundrymen will rally round and give us their assistance. I shall be pleased to receive the names of anyone willing to join this very important movement.

Wm. Finch, *Secretary and Treasurer.*

Correspondence.

FOUNDRYMEN'S CONVENTION.

To the Editor of THE FOUNDRY TRADE JOURNAL.

DEAR SIR,—Mr. "Finch's" note although satisfactory in so far as it goes, could have done nicely without his regrets for having "ruffled my feathers," as he puts it. But not being very thin skinned I trust to have the pleasure of meeting Mr. "Finch" at Manchester, and I have not the slightest doubt that I shall find him to be a gentleman whose "bark is worse than his bite." May I give the first week in August as the most suitable for me.

Your Scotch correspondent—where is he? Has he gone into "sackcloth and ashes" on the reflection that it is "a dirty bird that fouls its own nest?" Surely not. Therefore, I should like to hear from him what prospects there are, or, if any, of a Scotch meeting; and, as a preliminary, I would suggest that it be divided into three districts, namely, Glasgow, Edinburgh, and Aberdeen. — Yours faithfully,

CANNY SCOT.

WAKE UP ENGLAND.

The celebrated speech delivered by H.R.H. the Prince of Wales at the Guildhall on December 5th, 1901, has had a rousing effect on many of our manufacturers, and on none more so than Messrs. Graham, Morton & Co., Ltd. It had the effect of putting this firm decidedly on their mettle, with the result that is amply stated in the following correspondence:

"Leeds, April 15th, 1904.

"Dear Sir,—In a speech made by H.R.H. the Prince of Wales at the Guildhall, on December 5th, 1901, on the occasion of his return home from his Imperial journey, you will recall that as one of the lessons learned on his tour he made use of the following rousing expression: 'The old country must wake up. . . . . .'

"That speech is now a matter of history, and its value to the country has yet to be measured.

"As managing director of this company and as a British engineer it appealed to me very powerfully, the result being that I determined that the admonition given by H.R.H. should not fall to the ground so far as I am concerned. I therefore took the matter up forthwith, crossing to New York several times to investigate American business methods and workshop practices, with the intention, on my return, of designing, constructing, and equipping new engineering works as a test in record time, and so beating the American on his own ground, and demonstrating that the words of H.R.H. if taken seriously had a significance for British commerce that it would be thankless to deny and unwise to ignore. That some faith was necessary in thus expending a large sum of money at a time when other firms were practically discharging their men, and when business generally was at a very low ebb, is a significant point in the history of the undertaking.

"The result of my efforts is told in my letter of March 28th, 1904, addressed to the Prince of Wales, a copy of which I enclose you. It is also fully attested by a large and representative section of the press of the country, after a visit of inspection to the Works and Offices.

"The special object of this letter is to call your attention to the answer of H.R.H. to my letter, recording the results of his speech in my own particular efforts. That letter I consider as national property, and as such I have pleasure in asking you to print the correspondence.

"Yours faithfully,

"MAURICE GRAHAM."

"H.R.H the Prince of Wales,

"Marlborough House,

"London.

"SIR,—In a memorable speech some months ago you warned the engineers and

manufacturers of this country to 'Wake up,' complaining, and justly so, that many of us were sadly lacking in enterprise at that time.

"This speech made a considerable impression upon me, as I was making an exhaustive inquiry with reference to the design and construction of new engineering works to be built on the most modern and up-to-date principles, and also to cope with the American and German competition.

"I visited over fifty engineering works in the United States, and many in Germany, and the result of my travels has been the designing and construction of our large new engineering works in Leeds.

"One of the interesting features has been the rapid construction and equipment of the same.

"On May 16th, 1903, the first sod was cut; and in the same year, November 2nd, 1903, the works were completed, and in working order including the offices, the time being only five and a half months.

"This is an engineering record feat, and has been recognised by *The Times*, *The Illustrated London News*, *The Engineer*, and all the leading technical journals and press.

"I respectfully beg of you therefore to accept a souvenir illustrating this work, which has been done by a British firm in the short space of five and a half months, and which eclipses all American records.

"I have the honour to remain,

"Your obedient servant,

"(signed) MAURICE GRAHAM."

"Marlborough House,

"March 29th, 1904.

"Sir,—The Prince of Wales desires me to thank you for the copy of the souvenir illustrating what has been done by your firm in the design and construction of new engineering works, built on the most modern and up-to-date principles, which you have been good enough to send for His Royal Highness's acceptance. His Royal Highness has read your letter of 28th inst. with much interest, and desires me to congratulate you in his name on the great rapidity with which your undertaking was carried out.

"I am, sir,

"Your obedient servant,

"ARTHUR BIGGE."

OCCASIONAL NOTES.

THE accompanying illustrations clearly show the influence of annealing on steel castings containing 0·4 per cent. of carbon and 0·7 per cent. of manganese. Thus Fig. 1 reproduces a photograph of two bending tests—one as cast and the other as annealed. It will be noted that the cast-bar fractured on reaching an angle of 90 deg., whilst the annealed bar bent double without flaw. The chemical composition of the two bars is precisely the same; the usual method adopted for annealing steel castings involves no change in composition. The only change involved is a structural

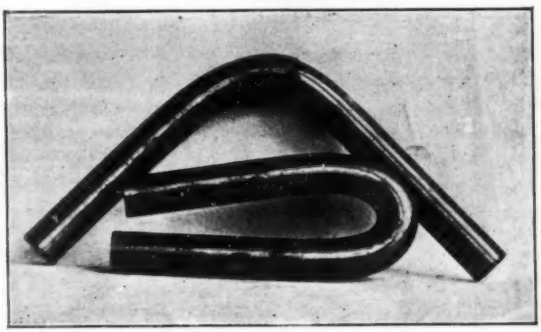

FIG. 1.

one, as a glance at the two following illustrations will show. Fig. 2 reproduces the structure of the steel as cast and magnified sixty diameters. The sharp and distinct character of the crystallisation will be

noted. Turning to Fig. 3, which represents the same steel after annealing, it will

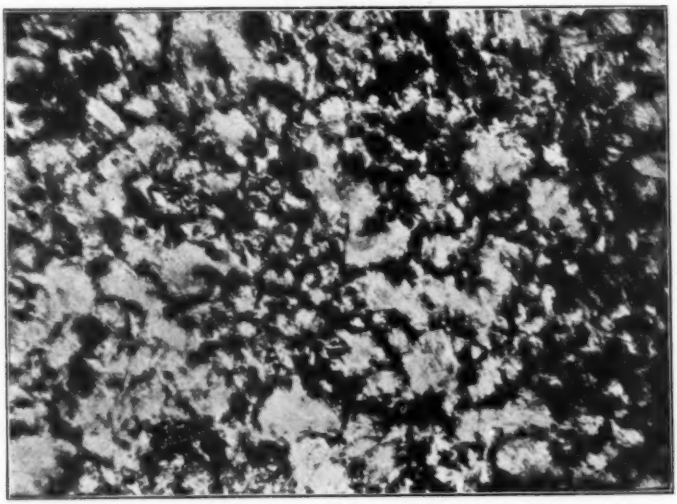

FIG. 2.

be noted that the structure is not nearly so distinct, and that constituents appear to merge one into the other; a fact accounting for the difference in bending angles depicted in Fig. 1. Annealing whilst relieving internal strains also has a beneficial influence on the structure or crystallisation in that it tends to dovetail the constituents one into the other, and by so doing promoting ductility. The castings from which these photographs are taken were annealed for three days (72 hours) at an approximate temperature of 950 deg., and then slowly cooled. PERCY LONGMUIR.

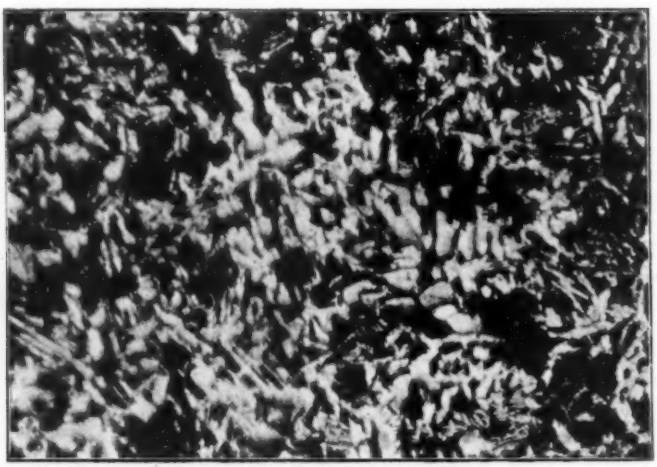

FIG. 3.

PRACTICAL FOUNDING.

"Defects in Cast-iron Castings."

By W. R.

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A FEW years ago I was led into a discussion, in *Engineering*, as to the causes attributable to defects, so frequently found below the surface, in the finishing of iron castings, and, as might be expected, not infrequently the theories advanced fell wide of the mark. Wherever defectiveness appears, whether it be a spongy surface, or it may be irregular holes, the popular verdict is always dirt, and, of course, caused by dirty metal. Such convictions are usually the result of inexperience, because of the fact that the greater majority of defects in castings below the surface are, in the writer's opinion, due to bad design, badly adapted metal, or neglected treatment in the matter of feeding, and position of casting.

In the interval alluded to foundry technics have grown apace, and nowhere is this more manifest than in the States of America. And, judging from recent experiences in this matter, it looks as if the future would see a chemist in most of the better conducted foundries throughout the United Kingdom Whether this may be an advantage or not time alone can tell, because, no matter what the constituents of iron may be, the phenomena of integral defects in castings, which never show themselves on the surface, will always, in my opinion, accompany the physical structure of cast-iron. Hence, unless the chemist be foreman and manager combined, the conflict of opinion may be great.

True, the metallurgy of cast-iron has a wide field for research, and it is but natural to suppose that there will be diversity of opinion on account of the dubiety admitted, which is characteristic of the chemistry of cast-iron.

It is not given to students of the chemistry of cast-iron to master the habits of metals, nor can it be said that metallurgy as acquired in the laboratory will ever solve sufficiently what is wanted in the foundry.

But while admitting their advantages when coupled with practice in the foundry, it will be a double gain to the practical moulder to acquire as much of those subjects as it is possible for him to get.

Thus we see that no matter however well adapted metal may be by the chemist, for any given job, if the detail of moulding and casting, and the after treatment as directed by the foreman be not all that is necessary, the best metal ever mixed will fall far short of securing sound and solid castings.

The meaning of the above must be obvious.

And here I am reminded of an article which appeared lately in a mechanical journal, by a popular foundry writer, on the physical properties of cast iron. The writer, after elaborating at considerable length to show (according to his way of thinking) that the top end of a vertically poured casting has the greatest specific gravity, goes on to say: "The test of a parallel gate which the author conducted, tended to show the fallacy of the idea that the lower end of vertical poured castings must be of greater specific gravity than the upper end." The above is contrary to all my experience, and to the opinions of such practical men as I have come in contact with. I know of nothing which can give increased density to metal in a fluid, or plastic condition, unless it be compression. Any mechanic with a junior understanding knows the importance of casting "face down." In my experience of casting rams there never was any trouble with the bottom end being defective, and the same is true of all other similar castings, when cast in a vertical position; indeed, any practical man with a knowledge of castings, seeing a ram for the first time as it came polished

from the turnery, would have but little difficulty in determining which was the lower end of the casting, as the top end invariably shows a more speckled surface when finished. This speckled surface is caused by the impurities, which are the lighter constituents of the body of the metal rising to the highest part in the vertical position at time of casting. This defect would be more pronounced were one foolishly to attempt to cast a ram with No. 1 Grey iron, as there would be such an accumulation of graphite at the top end as to make the metal altogether unsuited for the purpose intended, and this would be more so if the metal happened to be rather dull at time of casting.

The question may be asked: Is it necessary that rams should be cast in the vertical position? To this I say it is absolutely so, and no good is likely to come from attempting to cast in any other position. In order that this may be more easily understood, see Fig. 12, which shows a ram as it should be cast. A is the top end and B the bottom. A ram cast in any other position than this is not likely to give satisfaction.

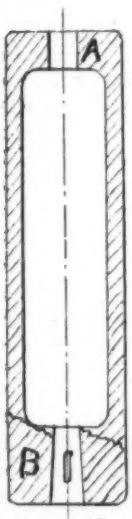


FIG 12.

I have known of rams giving way under tensional strain while working at the points indicated by broken lines at Fig. 12, the reason being that they were not solid on account of being the top end at time of casting. It may be that some one will say all this difficulty can be overcome by feeding. My experience teaches me differently. Although it can be minimised to a certain extent by such aid, it never can be mastered, as the pouring gates are too small to give the moulder sufficient time to completely solidify his casting, as he is compelled to retire at a time when the fluid metal is still contracting, the result being an imperfect casting, through drawn or vacuum holes. Be it observed there will be nothing visibly defective to the naked eye; but just as sure as it is a casting, if the B end be cast uppermost, the interior will be defective.

It is common to apply a sinking head as a cure for this evil; but unless this be of considerable depth, it is reckoned by many to be of little account. The cost of cutting the sinking head off is considerable, and has its proportional outlay in the Foundry also; therefore, by stratagem and experienced combined, it is possible to have no less satisfactory results, if not better, without the aid of the sinking head as mentioned. The foregoing confirms the advisability of casting the plug end up, as the plug end has but little tentional strain while working, the greater proportion of graphite and other dirt accumulated while pouring at this end is not a serious matter. Moulders, as a rule, prefer the cotter end to be the top end while casting, as they have a dread of the cotter core going to pieces, on account of the long drop the metal has to the bottom of the mould. No doubt with a drop of from 15 ft. to 20 ft. his dread is not without cause. A cotter core at this depth is almost an impossibility for the fettler to get out of the casting, because of it being metallised by such extraordinary compression; therefore the better way is to cast the end solid, and bore and slot the cotter hole, which gives greater satisfaction, with no additional cost.

Further, how can there be anything but increased density at the bottom of vertically-poured castings. Taxing iron to be approximately $7\frac{1}{4}$ times the specific gravity of water, what an enormous compression there must be at the extreme bottom of a casting 15 ft. or 20 ft. from the pouring head. The idea of a casting solidifying from the bottom upwards, aud its molecules becoming more dense as it rises

towards the top end, is contrary to the unalterable law of compression, as it relates to a fluid body while passing from this stage to its greatest completeness of solidification.

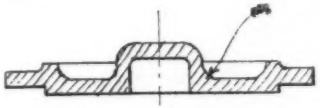


FIG 13.

Fig. 13 shows the back cover of a cylinder, as it is sometimes cast; such a casting is generally defective round that part to which the arrow points. The metal, as seen at the arrow, being badly arranged, results in a dirty-looking casting, the turner being unable to get the polish on it desirable. At first sight, to many, this defective surface looks to be dirty metal, it being so badly speckled on the surface; but a closer examination reveals the fact that it is porousness which is caused by the badly-proportioned form of this particular part of the casting. This porosity is quite visible all round in the region of the arrow, and at times the writer has seen it so bad as to condemn the casting of the porousness of this part being insufficient to withstand the cylinder's working pressure, consequently the cover is liable to sweat, thus making it an objectionable casting. Fig. 14 explains how to obviate this evil. In this Fig. we have a well-proportioned design, therefore it required no great practical understanding to observe that immediately on casting such a mould, the process of solidification sets to work over the whole body at one and the same time, and with ordinary mixed metal, suitable for machine castings and cast at the right temperature, the textural homogeneity of this casting may be said to be complete.

It will be noticed that Figs. 12 and 13 represent errors of design; scores of other instances might be added from which pain is undeservedly inflicted on the foundry. A mastery of design as to where to put on metal and where to take it off would in many of the best established engineering concerns in this country save much time and money.

Although those two Figs. 12 and 13 show only enough to reduce the metal's specific gravity, in consequence of which its density becomes reduced round the region of the arrow, thus showing the bad effect which attends disproportionate metal, and but for it being a polished surface, would in all probability have gone unchallenged.

Fig. 14 is really what every draughtsman should work for, namely, proportionate metal wherever possible; but as is well known, such is at times an impossibility where many cores, valve seats, and junctions of angles, in spite of fate, create disproportionate and undesirable clubs of metal. Therefore the rest must be left with the moulder to master, who, if he has given the habits of metal the study it deserves, should in some measure be able to strategise, and thus by experi-

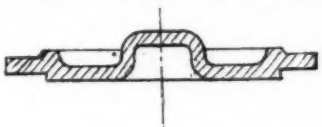


FIG 14.

ence overcome, if not altogether remove, the evil which would otherwise have produced a defective casting, or perhaps a waster altogether.

Briefly, let it be the endeavour of those who have to design for the foundry, to seek for proportionate metal, and be careful in placing "stay bars" with the ostensible intention of strengthening the job, which experience has in too many cases proved a failure. Because, remember that which in structural work would prove of great strengthening value, the same in many cases when cast would mean its destruction.

Hence I say to engineers and moulders alike, seek to master the phenomena of

shrinkage in all its phases, if that were possible, for with it much of the success of engineering and mechanics in their broadest sense depends. This attended to will make defective and bad castings a diminishing quantity, and make the foundry of the future have less of other people's mistakes to bear.

PORTRAITS OF PIONEERS.

IV.—Robert Abott Hadfield, M.Inst.C.E.

MR. R. A. HADFIELD has won many distinctions. The Bessemer Medal is to be presented to him at the forthcoming meeting of the Iron and Steel Institute.

Of an old Sheffield family, and educated in Sheffield, he showed a strong liking and aptitude for chemical and metallurgical investigation. At home he had an experimental melting furnace and appliances, and when fifteen years of age he entered the chemical laboratory of his father's works at Attercliffe.

Perhaps the most striking result of his metallurgical enquiries was the introduction of "Manganese Steel." Manganese is a metal which performs an important part in steel-making. An eminent French firm conducted experiments on the formation of steels containing higher percentages of manganese than had previously been made, and found that with the increase of manganese the resulting metal did not improve, but rather deteriorated. That they abandoned their trials is pardonable. The plucky manner in which Mr. Hadfield took up the subject and carried it to a successful issue is a good example of British pertinacity.

Briefly stated, ordinary mild steels contain about one-half per cent. of manganese, and slight additions beyond that quantity improve the good qualities of some steels. Steels containing from 2½ to 7 per cent. of manganese are brittle, but those with from 11 to 14 per cent., or over, are possessed of remarkable characteristics. They are tenacious and tough; hard without being brittle; they cannot be magnetised; and they are softened by being highly heated and quickly quenched. For many purposes manganese steel is unequalled.

Hadfield's researches concerning the influence of other metals on iron are

Robert Abott Hadfield, M.Inst.C.E.

voluminous. Scientific and technical societies have recognised that they are of the highest value. The George Stephenson gold medal, the Telford medal, and the Howard prize from the Institute of Civil Engineers, all these have been worthily bestowed on Mr. Hadfield. From France and from America much-coveted awards have been sent to him.

The commercial as well as the technical part of steel-making claims his energy. Since 1888 he has been Chairman and Managing Director of Hadfield's Steel Foundry Company, Ltd. Ten years ago he adopted the 48 hours week in his works. In 1899-1900 he held the honourable position of Master Cutler for Sheffield. He is an ardent supporter of Technical Education.—W. Macfarlane, F.I.C.

BRITISH IMPROVEMENTS IN IRON AND STEEL MAKING.

A Lecture by Mr. Walter Macfarlane, F.I.C., before the West of Scotland Iron and Steel Institute.

MR. MACFARLANE said:—It is indeed a pleasure to me to come back to this city, in which I spent so many of my earlier years; and I am pleased to see so many of my old friends here to-night.

The subject under consideration—that of British improvements in iron and steel making—will, I hope, appeal to you. We have heard a great deal of the superiority and success of our friends the foreigners. It has even been said they have out-rivalled us in many respects. But I think it might be well for us, once in a way at least, to look upon the bright side of the question; and if we do so, perhaps we shall come to the conclusion that this much maligned, and often reported to be worn-out old country, is not so very far behind after all. My own impression is that she continues to lead far in the front. With your permission, therefore, I propose to begin at the very commencement of the industry.

With the exception of an infinitesimal quantity, all the iron is extracted from the ore in the blast furnace. And, in order to keep up the continuity of my remarks, I may be allowed to say that a blast furnace is an upright cylinder 60, 80, or even 100 ft. high; that at a certain level of the furnace a powerful blast of hot air is forced, so as to maintain a fierce fire within the furnace—that fire, of course, carrying on the work that is done within the furnace. The materials to be treated in the blast furnace are sent up a hoist, trundled along in barrows, and tipped into a recess at the top which is formed between the cup and the cone. The "cup and cone" was introduced by Parry in the year 1850 as an improvement upon Hickmann's "cylinder and cone"; and the blast furnace, from the cup and cone at the top to the tuyeres at the bottom, is essentially British in all its lines and in all its details.

Then the hot blast, introduced by James Beaumont Neilson in the year 1828, has been instrumental in saving, and is still saving, an immense amount of our precious fuel, and thereby lengthening the life of our coalfields. Neilson was born at Shettlestone, which is not very far from where we now are. The water-cooled tuyere was invented by Condie, a West of Scotland blast-furnace manager. Then the hot-blast firebrick stove, an advance on the cast-iron pipe stove, was designed by E. A. Cowper, who improved it from time to time; so that, taken altogether, the hot-blast stove of to-day stands very much as Cowper left it.

While I have said all this about the blast furnace, and claimed in connection with it a primary place for Britain, I suppose I shall be in danger of being reminded that there are certain improvements in the working of the blast furnace the credit of which belongs to others—notably the American system of hoisting the materials to the top of the furnace by means of the "skip." In submitting to you the case from the British standpoint, I desire to be fair with our competitors; and I may say at once that the new system of hoisting is certainly a most excellent one; and, in a sentence, I may say that all, or nearly all, of the American mechanical contrivances are very good. But you must understand that the fundamental part of the American system of hoisting is the skip, which is filled with material at the bottom of the furnace, and is quickly whisked up an aerial railway to the top. I wish to remind you of the fact mentioned here by Mr. Edgar W. Richards, that the skip was in use at the world-renowned Low Moor Ironworks, in Yorkshire, more than a

century ago. Changed conditions led to the abolition of the skip in our country, while newer conditions led to its introduction in America; and in installing the skip in our remodelled works we are coming round to the re-adoption, in a better form, of what was previously in use in our own country.

The pig-iron which is made may be used either for Foundry purposes or for converting into wrought iron or steel; and if you will travel along any of these lines I think you will find the impress of the Briton in the improvement of them all.

Iron founding has been carried on for a long time. Since those early days when Abraham Darby and his faithful Welsh assistant, John Thomas, cast common pots and pans in a shed with screened windows, barred doors, and plugged keyholes, in the time of good Queen Anne, even until now, improvements have been going on in the manufacture of iron castings. The different districts of Britain have contributed their share of this improvement. When the late Dr. Roebuck, of Sheffield, established the Carron Ironworks in Scotland, a great impetus was given to iron founding. Professor Turner, of Birmingham University, whom you had the pleasure of hearing here in January of last year, has carried on investigations which have met with the most cordial approval of practical American ironfounders.

Now let us take the question of wrought iron. Progress in the manufacture of wrought iron is bound up intimately with the history of our own country. If we hark back as far as the year 1765, we find metallurgy in Britain to have been in a deplorable condition. It may have been that the best of the then known ores were used up; but, whatever the cause, the wrought iron produced was then so bad that our officials could not use it, and were reduced to the extremity of getting all their wrought iron from foreign sources. Then Henry Cort improved the manufacture. The financial history of Henry Cort was most distressing, but I shall not dwell upon that this evening. He improved the wrought iron manufacture, and brought it to such a point that we became for the time being independent of foreign supplies. Then later, somewhere about the year 1816 or 1820, Samuel Baldwin Rogers introduced certain improvements which at that time were urgently called for. After the introduction of the hot blast, which means the production of a silicious pig-iron, the wrought iron manufactures again got into a very bad way. But there is truth in the remark made by the late Sir William Roberts-Austen, that "progress has always been made by intellects such as our country has always had in our hours of industrial need." When the hot-blast iron blast did not suit the then conditions of puddling, Joseph Hall, of Tipton, worked, with others, and improved the process. The name of Joseph Hall ought to be better known. Visiting his old works at Bloomfield, in Tipton, about two or three months ago, I saw the method of roasting cinder for the production of "bulldog," which was going on just as in the days of Joseph Hall.

So much for iron casting, and so much for wrought iron. We now come to a bigger subject—that of steel.

Tool steel, as we now understand it, was first made by Benjamin Huntsman, in Sheffield, more than a century ago. Tool steel is essentially British; and self-hardening steels were first introduced by Robert Forrester Mushet. Mushet belonged to a Scotch family. His father belonged to Kincardineshire, and was for a long time associated with the Clyde Ironworks, in our own neighbourhood. His son, Robert Forrester Mushet, was born in the Forest of Dean; and to that was due the "Forrester" in his name. Then with regard to these newer steels—Bessemer steel and Siemens steel.

Bessemer was of French extraction; but he was British-born, and British in his sympathies. Furthermore, that beautiful process of his was not completed, at least as far as the use of hematite was concerned, until the work of Mushet was incorporated. Sir Henry Bessemer himself most handsomely acknowledged the work of Mushet, and said that "beyond any shadow of doubt Mushet's idea was supplementary to his own." In order to make steel—I hardly need tell the steel makers this—it is necessary to have ferro-manganese. Bessemer, feeling the need of some new compound, consulted one whom he was pleased to call "a very clever chemist," namely, the late William Henderson, of Glasgow and Irvine. Henderson was born at Westmuir, and, after his interview with Bessemer, he made fairly good manganese, and on a larger scale, in one of the works in the neighbourhood, he set up a reverberatory furnace, into which he afterwards put a working bottom made of crushed coke bound with tar. Henderson continued to make ferro-manganese in that furnace for three years; and it is interesting to know that the novel working bottom had only worn away one inch in that time. The success of both the Bessemer and the Siemens processes for the production of mild steel is to a large extent built on the work of Mushet and on the work of the late William Henderson of our own city.

We go one step further with regard to the Siemens process. We accept the dictum of Dr. Percy "that the Siemens process is the most highly organised result of regenerative-furnace evolution." That is as true to-day as when it was written. And we also agree with his remark that "while we are indebted to Messrs. Siemens for by far the most successful and economical method of applying waste heat, we should be most unjust to their predecessors if we omitted to give them the credit of having clearly apprehended the fact that great economy would result from the utilisation of waste heat, and also of having devised ingenious methods for effecting such utilisation." Of these predecessors first and foremost we must name a reverend gentleman, the late Dr. Stirling, who was parish minister of Galston for the long period of fifty years. An all-round man, Stirling sometimes surprised his neighbours at midnight by the terrible resoundings from the anvil in his little smithy adjoining the manse. But the work which concerns us most as iron and steel people was the fitting up by himself and his brother of an engine which was run on what we now call "the regenerative system." Without "the regenerative system" we cannot attain the temperature needed to carry on the Siemens process. Thus, if you take these steel processes from first to last, the Briton comes in with the essential part here and there.

In further connection with steel making, I will now speak of a gentleman who was not British-born, namely, the late John Gjers, formerly of the Cleveland district, who was the inventor of a calcining kiln—perhaps better known as the one who introduced the "soaking pit," by which it is possible to heat ingots for rolling without expenditure of fuel. I have introduced this portrait of Gjers to emphasise the fact that, even when improvements have been brought out by foreigners, they have been worked up in British works. Gjers came to this country from Sweden when twenty-one years of age, and liked it so well that he afterwards stayed in it, and invented the soaking pit and some other improvements.

If you look into the history of alloy steels, you will find that the Briton has carved his name high and deep. For instance, a famous French firm experimented with this steel, carried experiments to a certain point, and then dropped them. Afterwards the matter

was taken up by Mr. Hadfield, of Sheffield; and he, pushing the experiments further, made a success of manganese steel, which is to-day such a help to engineers when they require a material which is both hard and tough. For certain railway purposes it is unequalled.

And there are certain British specialities which I would like to mention. Notwithstanding the much-talked-of progress of our rivals, Staffordshire cold-blast pig-iron holds its own all the world over to-day. For certain purposes nothing is better than Staffordshire Treble Best; and where metal is subjected to certain very trying conditions, and required to endure these conditions for a long period, the world knows nothing better to-day than best Yorkshire iron. You will thus see that, despite all the talk, we still hold our own, and hold it very well.

But then someone might say, "Oh, that is all very well for the past; but how do we stand to-day, and how are we likely to be able to face the future?" I hope to be able to show you that in many respects our position is very good. Consider our position with regard to men, materials, and machinery. Our workmen are the best in the world—that is, when they like. With regard to managers, we may be told that they are all very well in a way, but they have not that scientific training which the American and the German managers possess. Well, there may be something in that; but if we go a little deeper we shall see how much is in it. It is a very singular thing that, notwithstanding the high scientific training of the managers abroad, the chief improvements in the metallurgy of iron and steel are improvements which have been brought about by Britons in British works! Take, for instance, the getting of the phosphorus and sulphur out of steel. What have the foreigners done in regard to that, compared with what we have done? The first one to dephosphorise on a practical scale was Mr. Snelus; and the one who brought it to a commercial success was the late Sidney Gilchrist Thomas, the chief promoter of the basic process. I believe that the favourite method to-day for the elimination of sulphur is the one introduced by Mr. Saniter, who conceived and perfected on a working scale his system when at the works of the Wigan Coal and Iron Company.

There may be a certain amount of heroic comfort to be derived from the fact that the processes which have built up the American and the German trade are based upon improvements which we have developed on our own little island; but why do people talk as if we had not done the work, and why do they give credit to our rivals for that which we have accomplished?

Of newer processes making their way to the front, I mention two—the Bertrand-Thiel and the Talbot. We gladly put down to the credit of the Austrians the inception and development of the Bertrand-Thiel, which is an excellent process. It is conducted in one or two works in our own country with very great success, and we take the lead in regard to the development of this process. At a well-known Staffordshire works, they turned out no less than 29 charges from each of their Bertrand-Thiel furnaces, and that, too, in works which were not designed for that particular process. New plant is being installed which will increase even that very high output. The Talbot process was worked out in America, and possibly that may be the reason why there is an impression abroad that that process is an American one. Talbot, however, was born in Shropshire; he is of a Staffordshire family, and was trained in Staffordshire works.

Now, with regard to metallurgy as a science. Metallurgy has been practised from the earliest days, but metallurgy as

a science originated in Britain. The late Dr. Percy set himself the gigantic task of collecting from all parts of the civilised world particulars of the different processes being carried on, and some of these he experimented with in order to elucidate certain points. He wrote many excellent books, and, while we acknowledge with unbounded gratitude the value of books written by others, at home and in other lands, we unhesitatingly say that no man has written books at once so good and comprehensive as the volumes written by Dr. Percy. Consider for a moment one of the latest scientific advances in the iron and steel trade, namely, the introduction of the miscroscope as a means of finding out some of the peculiarities of steel. This is one of the scientific ideas which either the smart American or the patient, plodding Teuton might be expected to excel in and carry off the laurels. But the method—and a very valuable method it has proved itself to be—originated with Dr. Sorby, of Sheffield; and, while we admit and applaud the splendid work done by many scientists abroad, yet I feel justified in saying that no man has done more to bring this new method within the scope of the practical adaptation than Mr. John E. Stead of Middlesbrough, who is one of our own members. I therefore claim that, both in theory and in practice, the Briton has proved himself worthy of his sires.

What about the materials. Our own island—which is comparatively small—has for a long period been the home of an active iron-producing people, and sooner or later fears must arise with regard to the future supplies of ore. We have often been charged with want of enterprise, but let us see what is being done to bring forth additional ore supplies. I purpose showing you two views of the new breakwater which is being erected at Hodbarrow for conserving the mines there. It is a splendid piece of engineering, and includes a barrier 1¼ miles long, and one of the first things they dumped, as a preliminary, was a lot of concrete blocks, each weighing 27 tons. When one takes into account the magnitude of that work, and how completely it is being carried out, and reflects that it is to cost £480,000, he must conclude that there is still some enterprise left in the British iron trade.

What are we doing to increase the supply of ores from abroad? The mines in the north of Spain are very well known to us, and some people say that they are nearly exhausted. They must, of course, be nearer exhaustion now than they were some years ago, but there appears to be a tremendous amount of ore still left there. It is a most interesting district to visit. At the mouth of the river a large breakwater has been erected at a cost of something like £1,000,000, and, when one considers that that was built in order to facilitate the ore trade, and that the great bulk of the ore is for British consumers, then one must come to the conclusion that the British iron trade paid for the greatest part of that million of money to facilitate the transport of the ore from the north of Spain. Not only do we get large quantities of ore from the north of Spain, but much is coming from the south of Spain, and we are likely to get more and more of it from the southern part of that country. One Scottish firm has all but completed a contract there for the erection of a large loading pier, with all the latest devised contrivances for dealing with large quantities of ore in the most expeditious and economical manner. That loading pier, I understand, is to cost £100,000.

Then there is the question of the ore supply from Dunderland, away up on the verge of the arctic circle. We are promised immense supplies from that region, and it is said that some 80,000,000 tons of ore may be got by mere quarry-

ing, and without hoisting, and that the company which has taken over the claims there—a company with a capital of £2,000,000—have rights over 100 miles of iron bearing ground. Unfortunately the ores are lean. They are low in iron and high in phosphorus; but the company has enlisted the services of Edison to put matters right. Edison is generally supposed to be an American, but his father was Dutch, and his mother was of Scotch extraction. The finely-pounded ore will be conveyed through a hopper, and a little cylinder will be set revolving to spread the ore, which will descend in a fine stream, where the gentle influence of the magnetic current will separate the iron containing portions from the sand, phosphate of lime, &c. The portion thus enriched in iron will be mixed with binding materials and pressed into blocks of a convenient size for handling and for working in the blast furnace. Blocks already made have contained 68 per cent. of iron, 2·1 per cent. of silica; and less than 0·03 per cent. of phosphorus. I think in regard to iron ore we are in a fairly forward state, at all events the reproach that we lack enterprise is one which has no solid foundation in fact.

With regard to our fuel—for that is the next point in connection with our supplies—improvements must go on by which we hope to save a considerable amount of fuel, and to get more power out of the fuel. One of the greatest developments in the saving of coal is that of using gaseous fuel direct in gas engines, and the genesis of the idea of making the most of those vast volumes of gas which are generated in blast furnaces should be credited to the Scotch iron trade. The late Mr. Aitken, thirty years ago, advocated the scrubbing of the blast-furnace gases in order to recover the chemicals. That improvement seems to us an easy matter now that we have got over the difficulties; but it was a stupendous problem to any one at the time the question was being discussed. In the latter years of the seventies, the Scotch blast furnaces were, on an average, turning out perhaps a matter of eight million cubic feet of gas per 24 hours. At the same period the great municipality of Glasgow was turning out something like eleven or twelve million cubic feet, so that the average Scotch blast furnace was turning out two-thirds of the volume made and sold by the Corporation of Glasgow. To ask an ironmaster to attach to each blast-furnace scrubbing power to deal with two-thirds of the consumption of Glasgow gas was a pretty tall order. Aitken advocated it, however, and it was brought to a practical result by Alexander and M'Cosh, in the early eighties, erecting and working stupendous plant for the recovery of residuals.

By solving that problem they released the Scotch iron trade from grave difficulties, and they proved that it was possible to deal with huge volumes of such gases.

(*To be continued.*)

EXPERIENCE OF A TRAVELLER.

THIS is how an exceedingly amusing article is entitled, which has appeared in one of our leading American contemporaries, and as the author has invited any reader to question or discuss his statements, the humorous aspect of his paper constrains me to accede to his behest. Many, if not all, writers in the organ alluded to assume to be thorough "practical men," and this fact is an additional incentive to me to consider and endeavour to dispute their various statements—at all events, the assertions contained in the article in question. A disinterested or impartial reader of both sides of the question is frequently at a loss to determine whether England learns of America or America learns of England. Yet, if the

true state and history of affairs were revealed, it would assuredly be discovered that the preponderance and origin of good things in the way of important and substantial inventions, and the order and arrangement observed in the construction of machines,can be claimed by the mother-country. There are such occurrences as a pupil excelling his teacher in minor matters of knowledge, so this may be the position America holds with regard to a few features in the mechanical world. However, my duty and desire is not to occupy time and space with this tone of comment, which can easily become an inexhaustible subject, but to deal with the "experience of a traveller." From what we can glean from this gentleman's words, a traveller has to know all in connection with wood-working machinery. Of course, a man in this capacity may have a special knowledge of this branch of business, but the man who knows half of the possible knowledge pertaining to saw-mill machinery, as in many other sciences, has not yet seen the light. However, I must hasten to review the "experience of a traveller." Before doing so, it is essential to copy a few sentences from this racy and interesting article, which may enable us to discern the contrast of arrangement, erection, and management of saw-mill plant in America, compared with some other countries. Of course, it would be an entirely erroneous conclusion to form that all mills in America are or were erected and mismanaged on the unfortunate lines which characterise the one which this traveller visited, for no man with any claim to mechanical knowledge or scientific principles would attempt to build a mill in the manner described. In this country, I presume that makers of machines have the speeding of them when laid down; but with our friends it is some other factor who is responsible for the speed. No one should know better than the makers of machines what their general speed should be, and it is the rule that all important machines, at least, are tested as to speed ere the purchaser takes it over. Speed is an important feature with all machines, and, so far as the cutting capacity of tools is concerned, too high a speed cannot be given to saw-mill machinery, so long as the feed speed is commensurate with the revolving cutter's travel. The plant visited by "a traveller" is described thus: "The entire plant is well equipped with the very latest machines; but I am sorry to say that the manager is one of the kind of men who know everything. I failed to find one solitary machine throughout the plant that was speeded up to anything like a proper speed—some machines about one-half too slow, while the others averaged about one-half too fast. There had been no allowance made in the speed of the machine for extra hard or extra soft wood. Imagine a gang of wabble saws, 9 in. in diameter, and forming a cutter-head 12 in. long, being used for turning off wheels by making a cut clear across the face of a 56 by 10 in. wheel at one cut, the saws at the periphery of the teeth travelling over 6,000 ft. per minute, and the reader will be able to form a very good idea of what the balance of machines were doing, or trying to do." This is how our friend describes the order of things as he found them in this particular mill. Probably I can claim to know a little concerning wood-working machinery and saw-mill plant, but I am not ashamed to confess my utter inability to comprehend the purpose of the machines in question, nor our friend's reasons for condemning the existing conditions so strongly. In the first place, I was not aware that the speed of machines operating on hard wood practically required to be different from those working soft woods, *i.e.*, so far as the blocks and cutters are concerned. The definite rule is, with all important wood-working machines, one fixed speed, irrespective of the kind of wood being dealt with. Of course, slower feed speeds have to be applied when converting or working hard

wood, compared with soft wood, which means that the motion of tools must be higher in soft wood than hard wood, but that the revolving speed of any machine should be varied according to the kind of wood being run is an innovation or departure the advantage of which I fail to discern. However, if varied revolving speeds were expedient when hard and soft wood are being cut, we should certainly commend the higher speed for the former than the latter; but our friend insists on adopting the direct opposite. Why has he made the important omission of not giving his reason for such advice? To deal somewhat comprehensively with this point, it is perhaps necessary to quote further from the American writer. He proceeds: "I ventured a kindly suggestion to the superintendent to figure the speed of all his machines and make proper allowance for hard and soft woods. He asked me what I considered the proper speed for hard maple. I told him that the cutter should not exceed 3,600 per minute at the periphery of the cutters. He replied, 'I am running my machines according to commonsense, and the faster they run the faster they will cut.' On the third day, after he had ground his bits several times, he asked me to figure the speed of his moulding machine, which I did with pleasure, and found that the cutting edges of the bits were travelling 6,300 and the machine feeding at 54 ft. per minute. This, I told him, was entirely too fast for such hard wood and heavy cutting. I reduced the speed to 3,600 and the feed to 40 ft., and the bits did good work."

Now, it is much against my wish or disposition to declare any man's statements to be unreliable or untrue; but when assertions are made which are so obviously averse to sound and practical reason, as evidenced in the elementary principles of applied mechanics, one is prone to disregard their own wish and usual tolerance. To vindicate and explain my reason for not crediting our friend's statement regarding speed, it is necessary that we should consider the action of cutters and saw-teeth in relation to the revolving speed and feed speed. As saw-teeth and revolving cutters are similar in their action, so far as different kinds of wood is concerned, we shall take for example conditions embodied in the motions of the logband-saw, or the vertical log frame. With all wood-working machines it is essential that the cutters perform less work when operating on hard wood than on soft wood. The remark of the superintendent, viz., that "the faster machines will run the faster they will cut"—and this is the man who, in the opinion of the writer of the article, knows little or nothing about the business. If the utmost capabilities of a band-saw is 100 ft. feed travel per minute, the blade travelling at 6,000 ft., the possible rate of feeding must be attributed to the rapid travel of the tool. If the speed of the saw was increased to 12,000, the speed would likewise be doubled, viz., 200 ft. per minute; but the cutting work of each tooth would be identical in amount.

Though the production in this case is doubled, the performance of saw-teeth per foot is the same. Again, this saw may cut soft wood easily at 100 ft. per minute with the tool travelling at 5,000 ft., whereas if some kinds of hard wood were being converted of equal size, the feed rate would probably require to be reduced to 50 ft. per minute; but if it was possible to raise the speed of saw to 10,000 ft. instead of 5,000, the feed speed could with safety be retained at 100 ft. per minute. These mechanical conditions apply to reciprocating machines as well, for the feed speed chiefly depends on the number of revolutions of crank shafts, consequently, he who would suggest as a remedy for bad work in hard wood the lessening of the revolving speed, together with the feed rate, as the American writer did, must have had no practical experience of the facts or law which govern the motion of tools and wood-working machines.

Recurring to the instance referred to by our friend—the speed of cutters at edge or periphery was 6,200, and the feed rate 54 ft. per minute. He considered this speed much too high, and attributed the bad nature of the work produced to the speed; so he altered the revolving speed of cutters to 3,600 ft. per minute, and the feed speed to 40 ft., and he states that by so doing the machine accomplished its work well. Anyone with but the slightest experience or knowledge of machinery will admit that the former speed is much more practicable and up-to-date than the latter. The cutters had less work to perform with the faster speed per revolution than with the slower; and it is on these conditions that satisfactory finished work—especially in hard woods—depends. I am sure that if some of our modern machine makers were instructed to speed their moulding machine heads at 1,600 or 1,800 they would be puzzled as to the purpose to which the user would put such a machine, and that it could be fed at 40 ft. per minute while working hard wood would be a revelation which should amuse those who possessed an elementary knowledge of machines. If the edge of cutters has a speed of 3,600 ft. per minute, and the cutting points being at a distance of four inches from centre, it makes the head have but some 1,200 revolutions, so there must be something marvellous in connection with the heads that could be fed at 40 ft. in hard wood while revolving at this speed. Is the author of those statements not aware that the speed of revolving heads on moulding and matched boarding machines is from 4 to 5,000 revolutions per minute, giving a velocity of some 7,000 ft. to the periphery of cutters. For hard wood working, especially, the revolving speed cannot be too high, but as formerly mentioned, a slower speed-rate must be applied.

So far as I am aware, no makers in this country at least have special machines or fixed revolving speeds for hard wood, the essential difference in working the one kind of wood compared with the other (*i.e.*, hard and soft) being the alteration in many cases of the angles and strength of cutting tools, and the slower rate of feed speed, which must necessarily be given in the case of hard wood; so the idea that machines are made, or should be made, to order is a novel one. With makers of wood-working machinery, at least, so far as this country is concerned, all important machines are kept in stock, and can be supplied to purchasers "right away"; but with regard to the customs of our neighbours in this respect I may repeat a remark which I used on one other occasion—viz., our friends have a unique way of doing and putting things, as the following will show: "One great mistake made by some purchasers of machines is, they will not order a machine until the day they want to put it to use. Then they never let up on writing and telegraphing to hurry up that machine. We must have it, as our mill is standing still on account of this machine." The builder of the machine will rush his foreman, the foreman will rush the men; they find bad castings, and botch up the work. But everything must go; no time to wait for a change in this or that pattern; the babbit metal boxes are not half run. "Let them go," says the foreman; "we must ship that machine on the 10th or lose the sale." All hands are put on the job, and every man wants to get his job done first; pulleys, cylinders, and cutterheads are all about half balanced, but the machine is put together, belted up, and run off.

This system of going about business, both on the purchaser's side and the maker's, will afford amusement as well as astonishment to those who are in a measure acquainted with the solid methods practised outside the sphere of the stars and stripes. Some of us cannot but conjecture that the above record of procedure emanated from an undue expansion of the writer's imagination. Could any firm be so beside itself as to

order a machine on the very day that they require its use? In other words, will not have the courtesy to wait two days on the machine's delivery. "Our mill is standing still on account of this machine" fully reveals the inconsistency of the writer and his meagre knowledge of sawing or moulding mills. It is directly contrary to reason and the existing order of a saw-mill, which is worthy of the name, that entire cessation of work would take place for the want of one machine. A delay of work might occur in the department where the machine is to be installed; but this is vastly different from a complete stoppage of the mill; and I venture to say that no makers of machines, even in America, would resort to the makeshift methods described by this writer, however urgent the demand for it. By reading such articles we are liable to form erroneous conclusions concerning American methods. It is impossible for any man to acquire the slightest experience of all the methods in common use in America; they are so varied, and the country so extensive, that he would require to live 200 or 300 years—which would allow him a week or two at each mill having different regulations and practice—ere he could be a recognised authority on matters pertaining to wood-working in that country; so it is injudicious and unfair to include the whole country when dealing with the defective and inconsistent ways of working in some remote localities of that country. We are very liable to make mistakes and misrepresent in this way; and to writers such as the foregoing can be attributed the responsibility of causing others to form contorted and unwarranted opinions of our advanced and enterprising cousins.

A. MACKINTOSH.

E. and W. H. Haley, Bradford, have a contract at £656 12*s.* 6*d.* for 80 tons 10 in., 35 tons 6 in., and 24 tons 4 in. cast-iron pipes for Hipperholme District Council.

HAVE PLENTY, SIR.

"HAVE Plenty" of natural light in your foundry. It is cheaper and better than any artificial light.

"Have Plenty" of labourers. Their wages are not so high as the moulders' wages are, and they can do lots of things the moulders do.

"Have Plenty" of moulding boxes. A moulder can often put down two or three more per diem, but he will not trouble if there is an insufficient supply.

"Have Plenty" of all size brads in the stores. Moulders often spend one hour (9*d.*) looking for one pennyworth of them.

"Have Plenty" of facing sand always ready to hand. £2 per week will soon go if moulders are allowed to mix and carry the facings.

"Have Plenty" of floor space for moulding. Get the labourers in at four o'clock in the morning to clear up, so that the moulders can start moulding at six o'clock. You will be agreeably surprised at the increased output if this method is adopted.

"Have Plenty" of fires in the foundry during the cold months. All moulders are just like other human beings, and can work better when they are comfortable. They will then keep at their work, and not run into the stove to warm themselves every half hour.

"Have Plenty" of all requisites. It is only badly-managed shops that run short of stores.

"Have Plenty" of tools for the men, or you will see Jack standing still for half an hour while Bill uses the rammer.

"Have Plenty" of water laid on all over the foundry; if there is only one tap labourers often have to travel many miles in the course of a year, which represents a goodly sum, which would be just as well in your pocket.

"Have Plenty" of lifting power. Some people think that one good, quick, electric lever will serve the purpose; but however quick that one crane may travel

it can only serve one man at a time, and the other men don't mind waiting.

"Have Plenty" of yard room, wherever possible, to stack the boxes; don't have the shop lumbered up with boxes and tackle.

"Have Plenty" of facilities for conveying the boxes and tackle from the foundry to the yard. Plenty of yard room is no good unless.

"Have Plenty" of room for the fettling; do not let it be done in the moulding department.

"Have Plenty" of supervision. If all is left to one man, so soon as his back is turned the work slackens down.

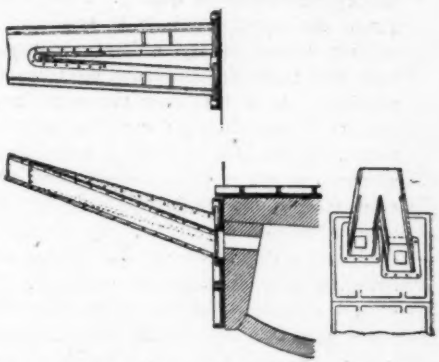
If you follow these little hints they will help you to make plenty of profit.—J. A. PHILLIPS.

THE CONTINUOUS STEEL PROCESS IN THE OPEN-HEARTH FURNACE.

IN a recent issue of *Stahl und Eisen* Herr S. Surzycki advances the claim that, putting on one side the earlier attempts of Mr. F. Siemens and others which have found no practical application, the employment of a fixed open-hearth furnace with more tap-holes on the tapping side is not new. On the contrary, since September, 1902, the continuous working of an open-hearth furnace has been carried out by Herr Surzychi at the works of the B. Hantke, at Czenstocha, with satisfactory results.

This practice consists essentially in the arrangement of two or more tap-holes situated one over the other, but not in one line, which lead into a double spout, by which the whole or only a part of the contents of the furnace are easily tapped, at any time. The accompanying cut explains this. These openings are arranged in a cast iron plate which is bricked with magnesite bricks and stamped with dolomite. They answer admirably, and during a continuous campaign of several weeks they neither shift nor sink, nor even corrode the same may be said of the hearth, which, without any repair, remains sound for months. At first, at Czenstocha a 20 ton furnace was employed experimentally on this process. The results obtained were very favourable, and a 30 ton furnace was then built in the same way. A larger and deeper and wider furnace is now being built.

The process is carried out in the following manner. The furnace is first charged with cold, clean scrap. As soon as this has reached the melting point, molten pig-iron direct from a blast furnace or from a



TAPPING HOLES AND SPOUT OF OPEN HEARTH FURNACE.

mixer is poured in; when the bath is quite quiet and perfectly melted, a considerable amount of iron ore and mill scale is added, and after that a further amount of pig-iron is poured in. The charging lasts until the furnace is quite filled up; the charge is dephosphorised in the ordinary way by additions of lime, and when decarbonisation has reached the required point the furnace is tapped. With a 20 to 25 ton furnace, which by making the hearth deep enough, can hold from 45 to 50 tons of molten metal, the tapping holes are so arranged that charges of 25 to 30 tons of metal are tapped, leaving from 25 to 30 tons behind in the furnace. The deoxidation, that is the making ready of the steel, is carried out by means of wood carbon and ferro-manganese

additions made in a ladle by throwing carbon in small pieces and ferro-manganese into the ladle during the tapping of the charge, whereby there is produced a lively reaction which is characterised by a high flame; but the contents of the ladle soon become perfectly quiet, and one can then proceed to cast the ingots. Large ingots of about one ton weight down to small ones of about 300 lb., for beams, angles, merchant iron, wire, &c., are cast. The steel remains quite quiet in the ingot moulds, and can be rolled perfectly, and shows in every respect a perfectly satisfactory homogeneous quality. After tapping, the upper tap-hole is easily and quickly closed in the ordinary manner with dry burnt dolomite, and the furnace repaired. As a rule only the slag line, and, to a less extent, the blocks require repair. There is then added a calculated amount of ore and roll scale, and an amount of pig-iron corresponding to the amount tapped is run in. By this last operation a very lively reaction is brought about, with a considerable development of heat, so that the interior of the furnace becomes strongly heated, although the gas and air remain shut off. Through this reaction a considerable purification of pig-iron takes place, which is an advantage, and is, indeed, necessary in reference to the duration of the process. In this way the practice is carried on uninterruptedly usually from one to two weeks. When from any cause the remainder of the furnace contents must be cast this is easily done by opening the lower tap-hole.

This practice has been carried out at the Czenstocha Works for a year, and the results obtained have been eminently satisfactory. A furnace which, with cold additions only holds from 25 to 27 tons, and when working 80 per cent. pig-iron and 20 per cent. scrap makes some 65 to 70 tons of ingot in twenty-four hours, reaches by the above continuous process from 75 to 90 tons of ingot iron in the double shift by the employment of some 20 to 25 per cent. of iron ore and roll scale, and a yield of 101 to 102 per cent. (calculated on the metallic additions). It must be remarked that the pig-iron used contains 0·6 to 0·8 per cent. of phosphorus, and that the furnace is very shallow and narrow (8 ft. 8 in. and 20 in. deep in the hearth).

With the continuous smelting process the proportions of the tapped and the remaining metal are of the highest importance for the output of the furnace, a fact which has been repeatedly emphasised by Mr. Benjamin Talbot, and which has been fully confirmed by practical experience with large furnaces both in America and England. The greater the capacity of the furnace and the larger the mass of the metal remaining in the furnace, compared to the mass of the tapped metal, the less time is wanted for each heat, and the larger is the output.

The above-described continuous steel melting process, which is based on the Talbot process, has this essential advantage—that it may be worked in an ordinary fixed furnace, if not too small, and that the necessary apparatus may be supplied in a very short time and at a very low cost, whereas the erecting of a tilting Talbot furnace involves a considerable capital, but for the rest it offers the same advantages as the continuous steel smelting process.

SOLDER FOR ALUMINIUM.

THERE is hardly, perhaps, a workman working aluminium who does not employ a solder or a soldering process of this metal, the compositions or applications of which are not held secret, each claiming to possess the best recipe.

MM. Nield and Campbell, on the other hand, that the solder as given below would give a strong and durable joint, both in the case of aluminium or with its alloys. According to our *confrère, l'Electrolyse*, the composition of this is as follows:

Zinc.....	80 to 90 grs.
Aluminium	5 „
Antimony	5 „

The aluminium being melted in a crucible, the zinc is added in small quantities, and, after the melting of the zinc, the antimony is added. A little salammoniac (hydrochlorate of ammonia) is then added, the mixture is well stirred, and, the dross being removed, the solder is run into bagnettes.

The method of employing this solder is as follows: Scrape with acid the surfaces to be joined; afterwards heat by coating the surfaces with solder, which must penetrate into the metal; collect the pieces to be joined, heat sufficiently, melt the solder, and allow to cool. We are assured that solders made according to this process are scarcely visible upon pure aluminium, the colour of this solder being almost the same as that of aluminium.

THE SMALL CONVERTER *v.* THE OPEN-HEARTH FURNACE IN THE STEEL FOUNDRY.

By L. Unckenbolt, Charleroi.

In the technical press recently, a writer has set forth the economical advantages of the employment of a small Bessemer plant in Foundries producing steel castings. The author desires to controvert the assertion that it is possible to replace, with advantage, the existing open-hearth furnace by a small converter, and he is of opinion that there is a separate field for each, economically speaking. It must be allowed that with the Bessemer plant the output can be without loss made to correspond with the demand. It is also possible to make, not only small and thin castings but pieces of considerable thickness and weight. In the case of a new undertaking, before the acquisition of regular customers and in the absence of a trained staff of workmen, the advantages mentioned would seem to tell decidedly in favour of the small converter. On the other hand, the Bessemer process of making steel is more expensive than the open-hearth method.

On this account we often find Foundries after working for a number of years with the small converter and having thus acquired a regular connection for their manufactures, decide upon the erection of an open-hearth furnace. With the combination of an open-hearth furnace and a small Bessemer plant, anything in the steel casting line can be turned out. The advantages of the former, however, are not few. First of all, no machinery is necessary for working the furnace, and there is again the facility of ascertaining the actual composition of the bath by taking samples at frequent intervals. It must, however, be admitted that an attentive operator is always cognisant of how far the process in the converter has advanced. The appearances of the flame, together with the measurement of the blast pressure and of the time, enable him to follow the various stages with accuracy. Again, in the open-hearth furnace the waste of metal is less, consequently the cost of the raw material comes out lower. On the other hand, there is certainly the disadvantage that it is impossible to cast pieces exceeding a certain weight, since several charges cannot be collected, as they can with the converter, for one casting operation. Further, most steel Foundries utilising the open-hearth furnace find it desirable to run at the same time a rather expensively-working crucible furnace, with from four to six crucibles, the produce of which is employed for filling-in purposes. In the open-hearth furnace, on the other hand, it is very easy to use up the large spoilt castings, whereas with the small converter this is not so easy, because they have to be broken up, which is often a rather dear operation.

From the reasons stated it will be seen that the decision of the question as to which is the most economical is not a

simple matter. Nowadays, a small open-hearth furnace, with a capacity of from six to seven tons, including the gas producer, can be obtained for £2,500. On the other hand, we may put down a cupola furnace, with blower, at £250, and the converter, with blowing engine, at £500. The first outlay for the former is £2,500, as against £750 for the latter. In the case, moreover, of the Bessemer plant, we have an extra current expenditure, corresponding to the cost of from 50 to 75 h.p., for working the blowing engine, the crane, and the tilting machinery. In the writer's opinion, however, the consideration of the initial cost will not, as a rule, be sufficient to decide which system is to be adopted. The advantages of the small converter will only preponderate :—(1) Where it is desired to produce light castings in large quantities, and the orders for heavy ones are rare; and (2) in all cases where a business connection has to be established, and, consequently, the output from time to time will fluctuate considerably. If, however, it be decided to forego the making of light castings, and one can rely upon a tolerably uniform absorption of the produce with a well-trained staff of moulders, the advantage will remain with the open-hearth plant. In the latter, large furnaces are not desirable; the right size is from six to seven tons. It is better to have two small ones than one large one, say, of twelve tons capacity, because should at any future time the sales drop, the loss is twice as great with the large one. With the open-hearth furnace, once it is started it must be kept continuously working, otherwise the expenses mount up very considerably.

SPECIFICATIONS FOR BESSEMER STEEL RAILS.

THE American Railway Engineering and Maintenance of Way Association, at its annual meeting at Chicago, March 16th, adopted the following specifications for steel rails :—

(1) (A) The entire process of manufacture and testing shall be in accordance with the best current practice, and special care shall be taken to conform to the following instructions :

(B) Ingots shall be kept in a vertical position in the pit heating furnaces until ready to be rolled, or until the metal in the interior has time to solidify.

(C) No bled ingots shall be used.

(D) Sufficient material shall be discarded from the top of ingot to insure sound rails.

(2) Rails of the various weights per yard specified below shall conform to the following limits in chemical composition :—

	50 to 59 lbs. Per cent.	60 to 69 lbs. Per cent.	70 to 79 lbs. Per cent.	80 to 89 lbs. Per cent.	90 to 100 lbs. Per cent.
Carbon	0·35-0·45	0·38-0·48	0·40-0·50	0·43-0·53	0·45-0·55
Phosphorus (max.)	0·10	0·10	0·10	0·10	0·10
Silicon (max.) ...	0·20	0·20	0·20	0·20	0·20
Manganese ...	0·70-1·00	0·70-1·00	0·75-1·05	0·80-1·10	0·80-1·10

(3) One drop test shall be made on a piece of rail not less than 4 ft. and not more than 6 ft. long, selected from each blow of steel. The test piece shall, preferably, be taken from the top of the ingot. The rail shall be placed head upwards on the supports, and the various sections shall be subjected to the following tests under a free falling weight :—

	Weight of rail, lbs. per yard.			Height of drop, ft.
More than ..	45 to and including		55	15
More than ..	55	,, ,,	65	16
More than ..	65	,, ,,	75	18
More than ..	75	,, ,,	85	20
More than ..	85	,, ,,	100	22

If any rail break when subject to the drop test, two additional tests will be made of other rails from the same blow of steel, and if either of these latter tests fail, all the rails of the blow which they represent will be rejected, but if both

of these additional test pieces meet the requirements, all the rails of the blow which they represent will be accepted.

(4) The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass the temperature of the rail will not exceed that which requires a shrinkage allowance at the hot saws of 6 in. for 85 lb. and 6¼ in. for 100 lb. rails, and no artificial means of cooling the rails shall be used between the finishing pass and the hot saws. The above shrinkage allowance may be varied, if necessary, so as to give a finishing temperature not exceeding 1,600 deg. F. at finishing rolls for mills rolling from reheated blooms, and not exceeding 1,750 deg. F. at finishing rolls, for mills rolling direct from the bloom to the finished rail.

(5) The drop testing machine shall have a tup of 2,000 lb. weight, the striking face of which shall have a radius of not more than 5 in., and the test rail shall be placed head upwards on solid supports 3 ft. apart. The anvil block shall weigh at least 20,000 lb., and the supports shall be part of, or firmly secured to, the anvil. The report of the drop test shall state the atmospheric temperature at the time the test was made.

(6) The manufacturer shall furnish the inspector, daily, with carbon determinations for each blow, and a complete chemical analysis every twenty-four hours, representing the average of the other elements contained in the steel, for each day and night turn. These analyses shall be made on drillings taken from small test ingot.

(7) Unless otherwise specified, the section of rail shall be the American standard, recommended by the American Society of Civil Engineers, and shall conform, as accurately as possible, to the templet furnished by the railway company, consistent with paragraph No 8, relative to specified weight. A variation in height of 1-64 in. less, 1-32 in. greater than the specified height, and 1-16 in. in width will be permitted.

(8) The weight of the rails will be maintained as nearly as possible, after complying with paragraph No. 7, to that specified in contract. A variation of 0·5 per cent. for an entire order will be allowed. Rails shall be accepted and paid for according to actual weights.

(9) The standard length of rails shall be 33 ft. ; 10 per cent. of the entire order will be accepted in shorter lengths, varying by even feet to 27 ft. A variation of ¼ in. in length from that specified will be allowed. All rails less than 33 ft. in length shall be painted green on the ends.

(10) Circular holes for splice bars shall be drilled in accordance with the specifications of the purchaser. The holes shall accurately conform to the drawing and dimensions furnished in every respect, and must be free from burrs.

(11) Rails shall be straight when finished, the straightening being done while cold, smooth on head, sawed square at ends, variation to be not over 1-32 in., and prior to shipment shall have the burr occasioned by the saw cutting removed and the ends made clean. No. 1 rails shall be free from injurious defects and flaws of all kinds.

(12) The name of the maker, the weight of rail and the month and year of manufacture shall be rolled in raised letters on the side of the web, and the number of blow shall be plainly stamped on each rail in at least two places not subsequently covered by the splice bars.

(13) The inspector representing the purchaser shall have free entry to the works of the manufacturer at all times when the contract is being filled, and shall have all reasonable facilities afforded him by the manufacturer to satisfy him that the finished material is furnished in accordance with the terms of these specifications. All tests and inspection

shall be made at the place of manufacture prior to shipment.

(14) No. 2 rails will be accepted up to 5 per cent. of the whole order. Rails that possess any injurious defects, or which for any other cause are not suitable for first quality, or No. 1 rails, shall be considered as No. 2 rails; provided, however, that rails which contain any physical defects which impair their strength shall be rejected. The ends of all No. 2 rails shall be painted in order to distinguish them. Rails rejected under the drop test will not be accepted as No. 2 rails. All No. 2 rails shall be painted white on the ends.

"FERRUM CEMENT."

THE demand among foundrymen and engineers and most other metal workers for a cement which, while it can be easily applied, will remain after setting impervious to the attacks of water and oil, and which will be as hard as cast-iron, and behave something like cast-iron when filed or machined, would seem in a fair way for fulfilment if the claims made on behalf of "Ferrum Cement" are well founded. This substance is made in two forms—Nos. 1 and 2. The makers, Messrs. B. J. Hall & Co., of 39, Victoria Street, S.W., state that No. 1 will harden in 20 hours, but that it continues to harden indefinitely, and after three days it can be filed and polished. It becomes highly metallic, and, apart from its lightness, might be easily mistaken for cast-iron. It is recommended when time can be allowed for slow setting. The No. 2 quality makes up stickily, and then stiffens very quickly. It soon attains a surface hardness, but does not metallise throughout sooner than No. 1. It takes a better polish, however, and retains it longer.

Messrs. Marshall, Sons, & Co., Ltd., Gainsborough, have on hand an order for a number of Lancashire boilers for the East Indian Railway Board.

ALUMINIUM ALLOYS.

THE employment of aluminium bronzes and brasses are becoming more and more generally adopted (says our French contemporary, "Science, Arts, Nature,") owing to their powers of resistance, the variety of their appearance, and the beautiful lustre which can be imparted to them.

Thus, bronze containing 75 per cent. of aluminium is of a golden colour. It is largely employed in the making of powdered bronzes, such as bad gold, preferably with other alloys on account of the fact that, relatively speaking, it does not alter.

The manufacture of aluminium bronze requires quite special precautions. It has been said that when aluminium has been added once or twice to melted copper a very appreciable raising of the temperature is observed.

M. Kiliani, in the *Industrie Métallurgique* (from which these extracts are taken), explains this fact, which was attributed exclusively to a chemical combination between the copper and aluminium, by the presence of copper oxydul contained in commercial copper and which is only increased by the process of fusion. The aluminium, in the presence of this copper bi-oxide, brings about its reduction in order to form alumina with an enormous emission of heat, which explains, at least, in a measure, the phenomena in question.

Manufacture of Bronzes.

In order to obtain alloys of good quality especial care must be lavished upon their manufacture. They can be directly obtained with the crucible, but the oxidations and other causes make a second fusion necessary to bring the bronze to the proper standard.

Those works making pure aluminium prefer to make the bronzes by a mixture of two metals, a satisfactory alloy being then made at one stroke. The copper is melted, the aluminium being then added

by degrees, taking care to raise the temperature as little as possible.

The alloy thus obtained should, to be homogeneous, undergo several fusions.

Le Verrier thinks that it would always be as well to terminate the operation by an addition of pure aluminium, which would reduce the oxide of copper which had formed. For the different fusions plombagine crucibles are generally employed.

Moulding Process.

The moulding of aluminium bronze, like that of pure aluminium, is a delicate operation; this being principally due to the considerable shrinking of the alloy upon cooling, this shrinking varying from 1·8 to 2 per cent. Liquations are not to be feared, and moulding can be effected either in sand or in shell. Stout objects can be moulded at a relatively low temperature, whilst delicate pieces must be moulded in a fluid state.

Bronze Working.

Aluminium bronze is malleable at almost any temperature, but it is between a dull and bright red heat that it is easiest to work. If worked cold, frequent re-roasting would be necessary.

Scraping is done in acidulated water, as in the case of copper. The presence of iron and silicium makes the metal more difficult to work.

Pressure of space preludes giving the manifold applications of this metal, suffice it to say, however, that it is used satisfactorily both on the Continent and in America.

Willans & Robinson, Ltd., announce that their steel works at Queen's Ferry, including the steel foundry, will be closed as soon as existing orders can be completed, owing to the depressed state of trade. Extensive reductions are being carried out in the Queen's Ferry staff and organisation, and every effort will be made to effect similar economies at Rugby.

METALLURGY OF IRON.

(*Continued from page* 103.)

TO continue from *La Métallurgie*, it may be said that the so-called "modern era" began towards the end of the eighteenth century. It coincides with the invention of the steam engine, which dates from 1768, but which was not generalised until 1790. This important event in industrial history had a double effect upon the metallurgy of iron.

On the one hand, it supplied Foundries with the means of introducing more powerful implements, hence facilitating the "working" of large material; and on the other, by creating fresh requirements and, as the result, new markets, an enormous increase in consumption was soon witnessed, which compelled metallurgists to seek every means in their power to perfect their respective processes, so as to ensure quick and cheaper production. That a complete transformation in the metallurgy of iron was soon resulted will not therefore be surprising.

The first phase of this transformation was brought about in 1784 by two inventions by an Englishman named Cort, viz., that of the puddling furnace and that of the fluted laminator.

In order to answer the requirements of increasing production of the forges, high furnaces were soon introduced of a larger type. In 1825 English high furnaces were from 32 to 40 ft. high, producing between 15 and 20 tons a day; in 1830 the employment of warm air was introduced into Scotland, when the height of these furnaces was increased to 60 ft., producing 40 and 50 tons daily. It was about this same period that the puddling process was perfected.

It is interesting to observe that during the whole of this period, English trade kept in advance of that of the Continent, where progress was adopted, but very slowly.

The first phase of the "modern era" may, therefore, be characterised by the

co-existence of old and new processes. A second phase began about 1840, when the disappearance of all those factories working with wood was witnessed. We are told that the English processes became generally adopted as soon as they were perfected.

It does not require any very technical mind to realise that the introduction of railways brought about a fresh and very large consumption, at the same time requiring that the material should be of much larger dimensions than was formerly the case. To the consumption of metallurgical materials for railways has to be added that for buildings and ships, so that the demands for metals became enormous as compared with that heretofore existing.

With the development of the means of transport, however, all trading conditions were very quickly changed; for by large works being enabled to forward their merchandise over a larger area, a universal competition was speedily brought about which soon brought the smaller and more old-fashioned works to grief.

It was towards the year 1845 that the combustible gases from the furnace-mouth was first collected in Scotland, being used for heating warm-air appliances. In 1860 the first apparata of this kind made of brick was built in Cleveland, by which, quite obviously, a very much higher temperature could be maintained. These two discoveries effected an enormous saving in the consumption of fuel, and the raising of the temperature meant a great increase in production.

(*To be continued.*)

NOTICE.

Nous Adressons THE FOUNDRY TRADE JOURNAL *pendant une année, dans tous les pays, franc de port, pour la somme de 9 francs 50 centimes. Cette somme peut nous être envoyée par Mandat-Poste international ou par chèque payable en Angleterre.*

AMONG THE FOUNDRIES.

D. & B. Jones, engineers and iron-founders, Pontardulais, have secured another order for cast-iron street lamps for the Llanedy Parish Council.

The Moor Steel Works, Stockton-on-Tees, which were closed a year last October on account of the depression in trade, are shortly to be re-opened.

Guest, Keen & Nettlefolds, Ltd., have contracted to supply 10,000 tons of steel rails to the Buenos Ayres and Pacific Railway at 92*s.* 6*d.* f.o.b.

Mr. E. W. Moseley has retired from the Barnsley Iron and Steel Company, Barnsley. The remaining partner, Mr. T. Barron, will continue the business.

Colville & Sons, of the Dalziel Works, Motherwell, are having fitted an American charging apparatus for charging their furnaces.

The Holwell Iron Company, Ltd., of Asfordby, Melton Mowbray, have secured the contract for the cast-iron work and cast-iron pipes for the Cardiff water works at Heath reservoir.

The new steel works of J. Summers and Son, Limited, at Shotton, which have been in course of erection for some time, have now been completed, and will shortly be in operation.

Considerable improvements are contemplated in the blast-furnace department of the Dowlais Ironworks. In addition to new furnaces being erected, large blowing engines will also be put down.

R. Laidlaw & Son have contracted to supply 500 tons of cast-iron pipes from 5 to 3 in. in diameter, at a cost of £2,532 4*s.* 6*d.*, for the Glasgow Corporation Water Department.

According to the annual report of the Rivet, Bolt, and Nut Company, Limited, just issued, extensive improvements have been made during the past year to the buildings and plant at the Scotia Works, Rutherglen, and Stobcross Works, Coatbridge.

Beardmore & Co., Ltd., of the Parkhead Forge, Rolling Mills, and Steel Works, Glasgow, exhibited at the Motor Car Exhibition at the Agricultural Hall, pressed motor-car frames in nickel or mild steel, steel castings, &c.

W. Little & Sons and **P. R. Fleming**, of Glasgow, are recommended by the City Improvements Committee as the contractors for steelwork (£2,201) and cast-iron work (£413) for a new building in Nelson Street, Glasgow.

R. W. Blackwell & Co., Ltd., City Road, E.C., sent in the lowest tender at £34,296 for construction and reconstruction of tramways at Coventry, and their offer has been accepted by the New General Tramways Company, Ltd.

G. B. Smith & Co., Glasgow, have the contract for the steel and ironwork required for extensions at Neath market. Twenty-two tenders were sent in ranging from £6,500 down to £4,500, the offer made by the successful tenderers.

Bruce, Peebles & Co., Ltd., of Edinburgh, have received a contract for the complete installation of three-phase machinery at the Pumpherston Oilworks, embodying two 750-kilowatt alternators coupled direct to Willans engines, and upwards of sixty motors of varying capacity.

The British Griffin Chilled Iron and Steel Co., Ltd., recently obtained an order for 448 chilled cast-iron wheels mounted on axles for the Bengal-Nagpur Railway. The company are also supplying 400 33 in. diameter chilled cast-iron wheels mounted on axles for the Cuban Central Railway.

Alfred Hickman, Ltd., of the Staffordshire Steel and Iron Ingot Works, Bilston, Staffs., have fitted the powdered coal plant of the Central Cyclone Company, Ltd., to one of their Lancashire boilers. By its use they are able to burn waste coal which hitherto has been quite unmarketable.

The Dominion Iron and Steel Company, of Sydney, Cape Breton, expect to be making open-earth rails next autumn. A duty of $7 a ton will come into effect when the Sydney and Sault Ste. Marie Mills commence manufacturing. The average annual consumption of rails in Canada during the past ten years has been 110,000 tons.

Teasdale Brothers, Ltd., has just been registered with a capital of £30,000, in £1 shares, to acquire the business now carried on at Darlington, Stockton-on-Tees, and Bishop Auckland, and at Bedale, Yorkshire, to be carried on as Teasdale Brothers; and to carry on the business of railway material manufacturers, ironfounders, engineers, bridge, roof and constructional ironwork builders, railway contractors, manufacturers of and dealers in agricultural implements, &c.

The Globe Works, Tividale, which have been partially idle since Mr. C. Wilcox acquired them two years ago from Messrs. Wilkinson & Co., are, it is reported, to be re-started at once. The galvanising section of the works has been running fairly regularly all along, but the mills and furnaces have been practically at a standstill. Considerable structural alterations have been undertaken recently, and new furnaces have been constructed. It is understood that at least six puddling furnaces will be started at once, and two steam hammers will be requisitioned to deal with the work.

B. Bunch & Sons, of the Staffordshire Ironworks, Wallsall, have bought the Bloomfield Ironworks, Tipton, belonging to Messrs. W. Barrows & Sons. The Bloomfield Works were recently offered for sale by auction, but were withdrawn, as the upset price mentioned was not reached. Messrs. Bunch made an offer slightly exceeding that sum, and it has been accepted. The purchasers, it is stated, do not intend carrying on the works, but propose to get the minerals underneath, covering an area of about twelve acres. The break-up of these works, following on that of four others, has reduced the number of marked bar houses in the Staffordshire district.

MIDLAND NOTES.

There has not been any notable improvement in the Foundry trades during the last month, but from enquiries received in some quarters it is evident that there are some good orders waiting placement. In Walsall matters are more lively, and following upon the saddlers executing some war orders the oddside casters infer better trade. In some lines foreign competition tells heavily against the Midland ironfounders; but it is thought that with the advent of Mond gas into the South Staffordshire district the founders hereabouts will save considerably in smelting their iron and brass, and also reap a decided advantage in their annealing department. Tangye's, of Soho, are fairly well employed, as just now there is a run on their make of gas engines; and among the ironfounders who principally catered for builder's ironmongery specialities, orders are scarce in consequence of a slump in the building trade. The hollow ware makers say there are better orders flowing in, while those in the heavy lines are suffering great depression of trade.

It is gratifying to find that, although foreign competition is very keen, there are firms in the Midlands that occasionally are successful in competing against Continental firms. Messrs. W. G. Allen & Sons, Ltd., of Princes End, Tipton, ironfounders, have secured an important contract for the supply of 800 colliery tubs required by the East Indian Railways Board. This makes the fourth time Messrs. Allen have been favoured with orders from the same source, and this fact speaks well for the efficiency of the work the firm send out.

An important case came before the Wolverhampton County Court judge. The plaintiff was Thomas Hodgetts, Church Street, Heath Town, who up till recently has been employed at the Culwell Foundry of Messrs. Joseph Evans & Sons. It was an application to the judge to award suitable compensation for personal injuries Hodgetts had sustained at the above Foundry. Mr. Haslam, in stating the case of the applicant, said Messrs. Evans & Sons had admitted their liability to pay compensation, and had paid Hodgetts 10*s.* 6*d.* per week up till last November, when he left the Wolverhampton Eye Infirmary. They had also paid £2 5*s.* into Court, being at the rate of 2*s.* per week since that date, and the question the judge had to decide was as to how far the man was now in a condition to follow some kind of employment, not his ordinary occupation, which he was unable to do, and what amount of compensation he was entitled to receive. The applicant, who appeared in the witness box with a black patch over his left eye, stated that on October 6th last, whilst following his usual occupation in dressing a casting with hammer and chisel, a piece of metal flew off and struck him in the left eye, entirely destroying the sight. The sight of his right eye had been also since rendered dim through the accident. He had made several attempts to return to his work, and each time after doing a little he had to give up, suffering great pain in his head. A great deal of medical evidence was called, and the solicitor for Messrs. Evans in opposing the application, said his clients were willing to find the applicant ordinary employment as a labourer at wages of 18*s.* per week. If this was not accepted, they offered him, as an alternative compensation at the rate of 3*s.* per week until his right eye was sufficiently strong to enable him to earn his former wages of 21*s.* per week.

The judge said, after considering the evidence of the medical gentleman, the applicant was not yet in a fit state to do ordinary labourer's work, at which it was admitted he would still for a time endure some pain, but he might be able to do some light employment by which he could earn 12*s.* per week, and he therefore awarded him compensation at the rate of 6*s.* per week.

The receiver appointed on the behalf of the debenture holders in Watson Limited, Brassfounders, Paddock Lane, Walsall, sold the firm's stock, and arising out of the sale by auction was a charge preferred against three men—named respectively George Smith (41), The Butts; Edwin Bird (26), Whitehall Road; and William Evans (45), Hatherton Street—at the local police court of stealing eight ingots of nickel and a quantity of scrap brass. Two of the ingots were found by the detectives buried in a garden, the prisoner Bird, who was the auctioneer's porter, saying that he had put them there. He had found them under some bags at Watson's works. The prisoners all pleaded not guilty, and their solicitor urged that they had had nothing whatever to do with the ingots. With regard to the scrap brass, the magistrates would know that at a sale like the one referred to there was a lot of stuff about after the ordinary lots had been sold and carted away, and was it not natural to suppose that Smith, as a County Court bailiff and an ex-policeman, looked upon this stuff as having been abandoned. He admitted that Bird had put himself into an awkward position by burying two of the ingots when he heard that there might be some unpleasantness about them. The magistrates consulted in private, and their decision came as a surprise to the prisoners. Bird was sentenced to three months, Smith six weeks, and Evans to twenty-one days' imprisonment.

SCOTTISH TRADE NOTES.

(By Our Own Correspondent.)

THE year has not opened very hopefully for Scottish ironfounders. The general dulness which has been prevailing in the shipbuilding, engineering, and housebuilding trades has affected the ironfounding industry considerably, and work at the Foundries is quieter at present than it has been at the same period for a number of years. The competition for what business is going is gradually becoming keener, and for rainwater goods especially, the prices which are offered, and in some cases accepted, make it almost impossible to manufacture and deliver that class of material at present rates. The other day an ironfounder showed me some correspondence he had had with a customer who offered him an order for soil pipes, &c., at a price which the customer named, and which, after allowing for the price of transit, was below cost. The order was declined, and as it came from an English firm, it would no doubt go to a firm on that side of the border, who would be able to produce and deliver the goods at a small profit, on account of the smaller transit rate.

If the condition of the ironfounding trade of the country for some time past has any lesson at all, it is that there are presently enough, or more than enough, Foundries in Scotland. There have been comparatively few new starts of late, and it is a known fact that manufacturers' profits are being in many cases yearly reduced. There have been two old-established Foundries, one in the Falkirk neighbourhood, and the other near Glasgow, which have of late been in the market for sale, but they have failed to find purchasers. The fact is that a Foundry is not the gold mine it was in Scotland ten or twelve years ago. The last year's balance-sheets of limited companies have, with a few exceptions, shown very poor dividends, and so far as this year has gone there is little prospect of an improvement.

It is of interest to hear the opinion of at least one representative Scottish ironfounder with regard to recent trade conditions. Mr. J. C. Jeffrey Smith, the managing director of Camelon Iron Co., Falkirk, is by no means a chronic grumbler. He would rather that he could put a cheerful side on the existing trade situation. Speaking at the annual social gathering of the employees of Camelon Iron Co. a week or two ago, he said that in looking back over the past year he was sorry he was still

unable to record any improvement in trade. At the beginning of last year they thought they saw signs of a change coming; but it was a great disappointment to him and to them all that the change had not yet come. They must needs wear as cheerful a face as possible, and wait patiently until the turn of the trade. He commended to them the motto of the firm, "Look forward."

"Look forward" is the motto which has belonged many years to that old-established and well-regulated firm, Camelon Iron Co., yet at present it is the motto which many Foundry firms might almost adopt as their own. Whether the looking forward will have the desired good effect in the near future remains to be seen. The fact is that trade prospects are not bright, and competition is of the keenest description. There has been a talk of trying to get a sort of arrangement come to between Scottish and English Foundry firms to keep up prices, but whether anything will come of the suggestion is a moot point.

Scottish Foundry workers, who have of late been almost disheartened with little work and small wages, have been tickled with the glowing accounts spread abroad as to the fine field Canada presents for them. Numbers have gone there and regretted going. Mr. Archibald Logan, treasurer of the Central Ironmoulders' Association of Scotland, has recently received a letter from Mr. Robert Scott (formerly of Wallace Street, Falkirk), giving some information regarding the state of trade in Toronto, and asking that the information be made known to the members of the Ironmoulders' Association.

Mr. Scott, who was a member of the association when residing in Falkirk, says there are about sixteen Foundries in the city of Toronto, eight of which are union works and the other eight non-union. In the union shops the work is done by the day, the wages ruling being 2 dollars 75 cents per working day of nine hours, equivalent to 11*s.* 6*d.* in this country. He says it is extremely difficult to secure work at the moulding in Toronto, except a man is willing to sacrifice his trades union principles by "scabbing." There are three moulders for every vacant job. Mr. Scott says he has never got work as a moulder since he went out to Canada, but has been obliged to take work at stone-cutting, at which occupation, he states, he is getting along well.

About eight months ago a dispute took place in the moulding trade, the union men agitating for a nine hours' day instead of ten hours, which they were then working. The masters, with one exception, conceded the demand. The employers in the Canada Foundry Company refused, and the men formerly employed in these works are still idle, and the company are getting their orders executed by non-union men. Mr. Scott states he is sorry to say that the majority of the men who are "blacklegging" are Scotsmen, and that fact is giving his countrymen a bad name in Toronto. Hundreds of men, he says, are going about the city idle, and cannot get employment, and he asks Mr. Logan to warn the moulders in the Falkirk district to beware of agents visiting Scotland and advising men to leave their homes in the old country and emigrate to Canada. These agents may give great promises, he continues, but should the men go out they will simply find that a strike is facing them. The week previous to Mr. Scott writing the letter, about six hundred men left Canada for home, making the passage mostly on cattle boats, and glad they were to get back, for they had discovered that they had been taken out on false pretences.

Mr. Scott adds that the weather in Canada during the winter has been very severe, with keen frost and heavy snow dislocating freight traffic on the railways. Newspaper reports, he states, say that the winter has been the severest Canada has had for many years.

SHEFFIELD NOTES.

THE period of depression which for some time has prevailed in the Sheffield district continues, with very little alteration, and the outlook at the present time does not vouch for any immediate improvement from the already unsatisfactory state of things. The departments having to do with Government work are anxiously looking forward for any evidences of employment, and although rumours have been pretty plentiful of late of large contracts being made out for armour, &c., up to the present nothing of a definite nature has been forthcoming. Makers of forgings and castings for shipbuilding are better employed at present than they have been for some time, but the margin of profit must be exceedingly small considering the low prices which German firms are quoting for this class of work. Railway material is only in poor demand, the home companies continue to give out orders very sparingly, and orders from the colonies are gradually being worked off. A prosperous business is being done in tramway and light railway specialities, some very good orders having lately been booked with those engaged in this class of work.

The engineering trades of the city and district remains comparatively unchanged, but the outlook at present shows every indication of improvement, and with the opening of the second quarter the prospects are more brighter than at the commencement of the year.

The Foundry trade of the district, both iron and steel, cannot be said to be in a properous condition, nor are there any indications of this wished for condition. The steel Foundry trade especially is in but a poor way, and a great impetus would be needed to bring this branch into anything like satisfaction.

The latest quotations in Sheffield are: Lincolnshire forge, 44*s.* to 45*s.*; Lincolnshire Foundry, 45*s.* to 46*s.*; Derbyshire forge, 44*s.* to 45*s.*; Derbyshire Foundry, 48*s.*; East Coast hematites, 57*s.* to 58*s.*; West Coast hematites, 64*s.* to 65*s.*; Bar Iron, £6 5*s.*; Bessemer billets, £6 5*s.* to £6 10*s.*; Siemens-Martin, £7 10*s.*; steel hoops, £7 10*s.*

The Brightsides Foundry Co., Sheffield, have just completed two ingot moulds for Messrs. Cammels & Co., for armour plate castings, the weight of which are 38 tons and 34 tons respectively; also Messrs. Moorwoods, Sons, & Co. have had an order for the same class of work of 25 tons.

The Stanton Iron Company, Ilkeston, have given notice to their workmen employed in their iron Foundry for a 5 per cent reduction, which will effect about 1,500 men.

NOTES.

Mr. W. G. Pearson, who has been the representative in London of the North-Eastern Steel Company since the formation of the company, is about to retire from business, and will be succeeded by his son. Mr. Pearson will have the good wishes of the trade in his retirement.

The Institution of Mechanical Engineers has made a grant of £200 to the National Physical Laboratory, to aid in defraying the expenses of mechanical tests that are being conducted in that institution in regard to the behaviour of nickel-steel, and in particular to the phenomena of what is called the "elastic fatigue" of the alloy.

The returns of the German pig-iron output for February show the total in the Empire—including Luxemburg—to be 780,460 tons, against 831,053 tons in January last, and 744,835 tons in February, 1903. For the first two months of this year the total produced was 1,611,513 tons, against 1,536,888 tons last year, an increase of 74,725 tons, or 4·86 per cent.

The steelmakers of Scotland, the North of England, and the Midlands have come to an agreement not to compete in the sense of cutting prices for boiler plates in

their respective districts. The price of Lancashire land boiler plates has been fixed at £6 17*s.* 6*d.* a ton for the makers in all districts. North of England and Scotch makers have to pay carriage when they go into the Midlands, which for the Scotch makers means something like 12*s.* a ton.

Information is being prepared by the Board of Trade upon the available iron-ore resources of the world. Some time ago the British Iron Trade Association requested the Government to undertake an investigation into this question, and reports were called for from British consuls in various parts of the world. These are now in the hands of the Board of Trade, and are being collated by the permanent officials of the department, with a view to publication in a special volume.

Many ingenious processes have been developed for intensifying the oxidising action of air on metals by submitting the latter to reaction in the form of a finely-divided spray. The latest proposal, that of M. Harmet, has for its object the treatment of cast-iron, producing a refined iron or steel. Molten iron is caused to flow through a fine channel, surrounded by an annular air blast, which thus forms a tuyere, driving the metal forward in a fine spray. The spray is collected and allowed to flow together again in a receiving chamber, from which the molten steel can be tapped.

A new method for increasing the density of steel ingots was described recently in *Stahl und Eisen*. The object is to allow for the escape of occluded gases in the metal by keeping the upper part of the ingot in a fluid condition until the mass of the ingot has solidified. To accomplish this, a burner cap is placed on the top of the ingot mould and a gas blast flame is directed downward upon the metal; vent-holes at the sides of the cap allow the gases to escape. The flame is so proportioned as to keep the upper part of the ingot considerably above the melting point, thereby causing the ingot to solidify progressively upward. The metal can thus follow the contraction in volume and the gases are free to escape.

In the course of his speech recommending the adoption of the report at the annual meeting of Bell Brothers, Ltd., on Wednesday, Sir Lowthian Bell remarked that his son, Mr. Charles Bell, had prepared a statement showing the great change that had taken place in the amount of work performed by the blast furnaces. In the years 1854 and 1863 the average make was 269 tons a week, in the years 1864-1871 the average per week was 394 tons, in the years 1888-1893 the average make was 444 tons, and from 1894-1903 the average had been 519 tons per week. The present rate was 850 tons per week, and one furnace was making about 1,300 tons a week. He could take them back to the time when he first began to make pig-iron, when the make was only 70 tons a week, and in six months he increased the make to 140 tons a week, and used neither more coke nor coal for doing it. His furnaces were of about 4,000 cubic feet content, against the 24,000 cubic feet content of the furnace to day.

The production of all kinds of pig iron in Canada in 1903 shows a decrease of 54,139 gross tons or nearly 17 per cent, as compared with 1902, but an increase of 20,442 tons as compared with 1901. The total production in 1903 amounted to 765,418 gross tons, against 319,557 tons in 1902, 244,976 tons in 1901, and 86,090 tons in 1900. In the first half of 1903 the production was 132,930 tons, and in the second half it was 132,488 tons, a falling off of only 442 tons. Of the total production in 1903, 247,905 tons were made with coke, and 17,513 tons with charcoal. Nearly one-third of the total production was basic pig iron—viz., 126,892 tons. Less than 1,000 tons of Bessemer iron were made. Spiegeleisen and ferro-manganese have not been made since 1899. The unsold stocks of pig iron in Canada on December 31, amounted to 19,168 tons.

On December 31, 1903, Canada had 15 completed blast furnaces, of which nine were in blast and six were idle. Of this total, 11 were equipped to use coke for fuel, and four to use charcoal. In addition, three coke furnaces and one charcoal furnace were being built or were partly erected on December 31, but work on at least two of the furnaces had been suspended some time.

The returns of the output of Spanish iron ore show that, notwithstanding the gradual diminution in the yield of the Bilbao mines, the deficit is being more than made good by the steady development of the newer mines in other parts of Spain. Last year the production of the whole country was 8,478,600 tons, against 8,063,555 tons in 1902. The output in the Bilbao district alone was 4,760,000 tons in 1903, and 5,059,405 tons in 1902, a decrease of 299,405 tons. This, however, as the aggregate figures show, was more than counterbalanced by the expansion of the industry in the newer workings. It appears that the share of the entire product exported to the United Kingdom was considerably smaller in 1903, the total quantity being 4,947,028 tons, against 5,377,705 in 1902. The return shows that the whole of the increased production was sent to Holland. Probably, however, most, if not all, of the shipments entered as for Holland were destined for German blast furnaces, since there is no very important Dutch iron-smelting industry.

ORDERS TO PLACE.

Saturday, April 23rd.

STEEL FRAMEWORK.—Steel framework for car sheds. Particulars from Borough Electric Engineer, Bradford. Tenders to Harold Jevons, Town Clerk, Bradford.

Tuesday, April 26th.

MOTOR CARRIAGE. — Steam Motor carriage, tie bars and rails. Particulars from and tenders to E. Grant Burls, Director-General of Stores, India Office, Whitehall.

QUERIES.

This department of the JOURNAL *undertakes the answering of queries in the following branches:* Blast Furnace Practice, Basic (steel making) Processes, Cast-iron, Malleable Cast-iron, Steel, Brass, Bronze, &c., *by eminent authorities in each branch. When necessary, the aid of chemical analyses, mechanical testings, micrographic, or microscopic examinations will be invoked.*

The queries will appear repeatedly till answered. No charge is made to readers for answers, except where chemical, mechanical, or micrographic analyses are necessary, in which case the actual fee paid by us will be charged.

There are many other queries outside the scope above referred to which reach us at various times which we trust our readers will afford us assistance in answering.

Communications should be addressed to the "Editor, THE FOUNDRY TRADE JOURNAL, 104, Great Russell Street, London, W.C.," *and marked outside* "QUERIES," *and must be accompanied by the correct name and address of the querist, not for publication, but as a guarantee of good faith, which will be treated with strict confidence.*

Brass Liner.—Being an interested party in this job, and as failure to get a good casting occurred two or three times, I have thought, by bringing it before your readers, there might be information forthcoming for all concerned in this class of work.

Not being a brass moulder myself, I can only deal with the surface of things, and hope for a bit of give and take from all who may feel inclined to do so, and from what has been already given by your practical readers, I think your journal has improved by throwing its pages open for the discussion of practical questions such as "bad castings" or anything that is of interest in either shop or Foundry connected with the trade.

The casting in question when polished was more or less speckled with small black holes, say, in size from a pin point to about three-sixteenths of an inch, and of irregular dimensions which became

aggravated by grouping themselves in several places from top to bottom in zig-zag fashion—this, of course, condemned the casting. Some blamed it on the mixture of metal, others blamed it on the coke, and, as might be expected, the core and cope had their share of attention also

All agreed that it was dirt, but as to where it came from remains as yet a puzzle. If any of your readers would give us their opinion so as to assist us in future I shall feel obliged, and thus enable us to produce our work as near as possible with a first cast in this the age of keen competition. Wishing the journal the success it so richly deserves, I enclose my card and remain, yours very truly,

30th March, 1904. SUBSCRIBER.

Cupola Charges.—I have read a great deal in your paper about successful working of cupolas. I have been trying for some time to get the best results of ratio of iron to fuel for light castings; at the present time we are melting 10 ton × 8 cwt. to 10 ton × 12 cwt. per day to 17 cwt. of coke, ratio about 12 × 1, I believe; of course, this includes bed as well, which is 6½ cwt. I should be glad to know of anyone who has had better results.

FOREMAN MOULDER.

NUMBER OF FURNACES IN BLAST FOR THE QUARTER ENDED MARCH 31st, 1904.

An estimated output of pig-iron for the quarter based on average furnaces in blast for year 1903:

District.	Average Furnaces in blast, Quarter ended Mar. 31.	Estimated make of Pig-iron for Quarter ended March 31.
		Tons.
Scotland	86	323,164
Durham and Northumberland	26	238,826
Cleveland	48	484,256
Northamptonshire	12	69,392
Lincolnshire	13	75,825
Derbyshire	26	103,118
Notts and Leicestershire	14	74,312
South Staffordshire and Worcestershire	18	99,812
North Staffordshire	12	69,764
West Cumberland	18	188,012
Lancashire	15	153,575
South Wales	18	176,546
South and West Yorkshire	13	59,629
Shropshire	3	7 644
North Wales	1)	6,422
Gloucester, Somerset, and Wilts	1)	
Totals	324	2,135,297

—*Iron and Coal Trades' Review.*

METAL MARKET REPORT.

London, March 31st.

Tin.—There has been an appreciable increase in values during the month owing to strong demands from America, and firm advices from the East; there was also a fair amount of buying on account of China. Later weaker advices from the East caused a decline at the end of the month. Market closed on the 1st at £123 7*s.* 6*d.*, and on the 31st at £127 15*s.*

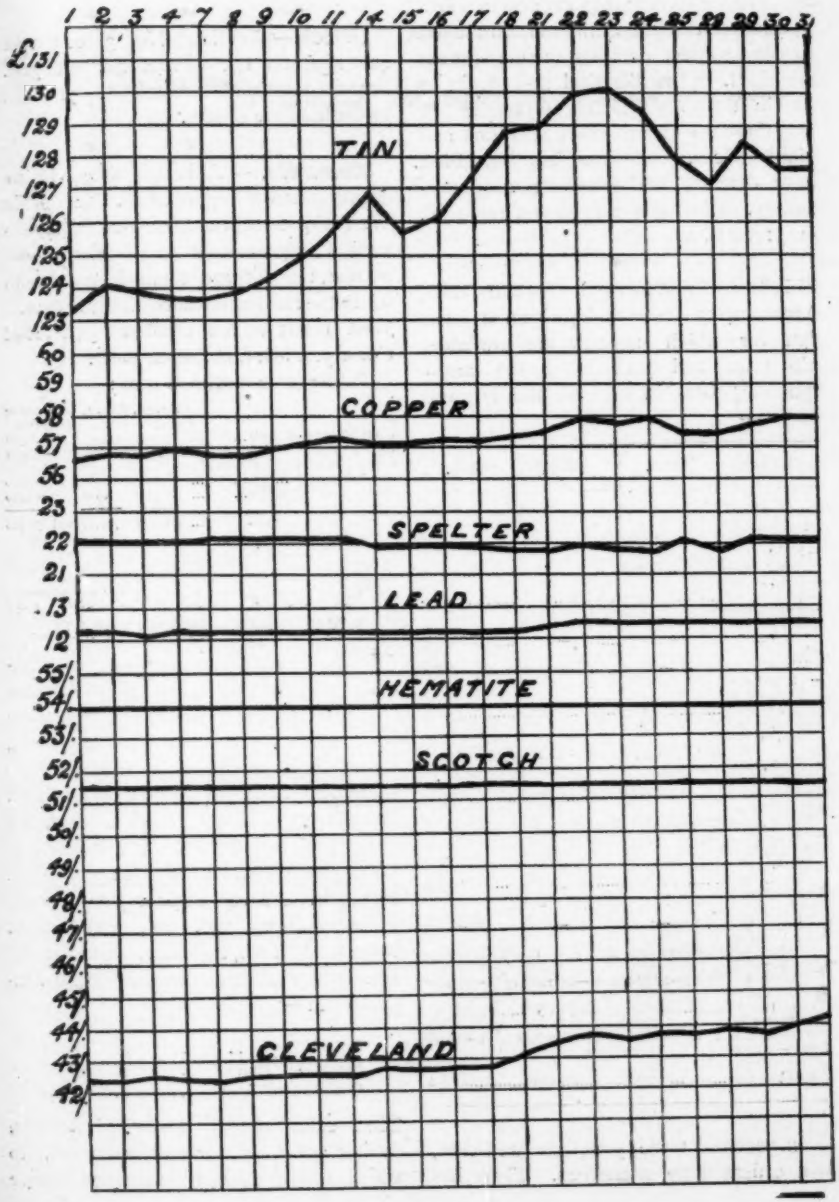
* * *

Copper.—Market for the most part quiet and uninteresting, buyers reserved, and sellers not disposed to force sales.

* * *

Pig Iron.—There has been a big

CHART OF THE FLUCTUATIONS OF THE METAL MARKET IN MARCH.



improvement in the trade of all consumers, with perhaps the solitary exception of steel rail makers, resulting in a very good business in Cleveland iron, makers finding it much easier to sell; they are now in a firm position, fluctuation in the warrant market having no effect on their prices. Stocks are short, orders plentiful, and stocks in public stores not sufficient to compete, we may therefore expect a very firm tone and higher prices. Not since last September have demand and prices been so satisfactory. Closing price on 1st 42*s.* 4½*d.*, on 31st 44*s.* 4*d.*

* * *

PRICES OF WHOLESALE COMMODITIES. APPROXIMATE prices and position at latest date for which statistics are available, with prices and quantities at the corresponding dates in each of the last two years :—

METALS.	1904.	1903.	1902.
Iron—Scotch pig warrant ton	52/3	54/0	54/4½
—Middlesbro warrants ton	44/11½	49/0	48/6
—W.C. M/nos Bessemer ton	55/6	61/	60/0
—Staffordshire bars, Lond. ... ton	£6 10—£8 10	£7—£7 5	£8—£8 5
—Welsh bars, Wales... ton	£6—£6 5	£6—£6 5	£6—£6 5
—Stock, Scotch, Apr. 15 tons	8,845	18,879	53,163
Copper—Chili bars, GMB ton	£57 17/6—£58	62 10/-62 11/3	£53—£53 1/3
—Stock, Europe and afloat... tons	13,299	14,384	28,124
Tin—English ingots ... ton	£128-£128 10	£137-£137 10	£128-£128 10
—Straits ton	127 2/6—127 5	135 17/6—136	129 10-129 12/6
—Stock, Ldn, Hlnd. and afloat... tons	10,963	10,240	11,709
Tinplates—Charcoal I.C..... box	12/6—14/0	14/0—15/6	15/0—17/0
Lead—English pig ton	12 10—12 12/6	£12 17/6—13	£11 17/6-£12
Spelter—Ord. Silesian ton	£22 5—22 7/6	22 10—22 12/6	17 15—17 16/3
Quicksilver—(75lb.) bottle	£8 5	£8 12/6	£8 15
Antimony—Regulus ton	£29—£30	£27—£27 10	£29 10—29 15
Coal—Lyons Wallsend, London ton	15/0	16/0	17/0

* * *

IN Scotland trade prospects are better, and orders fairly numerous. There has been little tendency on the part of makers to push sales, and prices have hardened. The warrant market has shown conspicuous lack of activity.

* * *

Prices.—Cleveland No. 3 rose from 42*s.* 4½*d.* on 1st, to 44*s.* 4*d.* on 31st. Scotch remained normal at 51*s.* 6*d.* throughout the month.

* * *

Hematite. — Although there is no improvement to report in the demand for West Coast makes, there has been substantial improvement in the East Coast market, the demand there is good both for home and export, and prices are dearer. West Coast mixed numbers 54*s.* East Coast 52*s.* 6*d.*, f.o.b. usual ports.

Public store stocks in tons :—

	Mar. 31, 1904.	Apr. 2, 1903.	Increase or Decrease.
Connal's at Glasgow	8,993	19,500	—10,507
Connal's at Middlesbrough,	96,829	131,700	—32,871
Connal's at Middlesbrough, hematite	300	1,300	—1,000
West Coast hematite... ...	19,950	23,900	—3,950
Totals ...	126,072	176,400	net 50,328 decrease.

THE RISE IN WARRANTS AND THE IRON TRADE.

THE second quarter of the commercial year opens with indications of improvement in the iron trade that are not without encouragement, though it is possible to exaggerate their significance. In the quarter which closed on the day before Good Friday, the striking feature has been the steady and considerable advance in pig-iron warrants. At the end of 1903 Scotch warrants were 49*s.* 9*d.*, Cumberland warrants 52*s.* 6*d.*, and Cleveland warrants 42*s.* 7*d.*; while the warrant stocks consisted of :—

	Tons.
Scotch iron	9,290
Cleveland iron	99,953
Cumberland iron	13,033

Then came several weeks of flatness, during which Cleveland warrants, to which all the business in the speculative

market is now practically confined, dropped below 42*s*. But towards the end of the quarter came a growing firmness, which continues ; and at the time of writing Cleveland warrants are 44*s*. 8*d*. buyers, with Scotch nominally at 52*s*. 9*d*., and Cumberland at 54*s*. 3*d*. There is less than the normal difference between hematite and ordinary iron, because hematite has been for some time in over-supply, owing to the prolonged dulness in the steel trad ; but the proportions are now becoming more normal. As to stocks, there were at the end of March 8,970 tons in the Glasgow warrant stores, with Scotch warrants in circulation for 8,650 tons ; 97,535 tons in the Middlesbro' warrant stores, with Cleveland warrants in circulation for 95,400 tons ; and 19,000 tons in the Cumberland warrant stores.

Now, the improvement in warrants has followed upon the steadying of the steel trade in the North consequent upon a not very intelligible spasm of revival in the shipbuilding industry. But it cannot be altogether attributed to that. Home consumers have been buying pig-iron fairly well, but not extensively, and as they were pretty well covered before makers sought to follow upwards the advance in warrants, they have rather suspended operations since the advance in "pigs" took place. But there has been a good deal of shipping going on. It is true that the shipments of pig-iron from Scotland have not been so large as last year, when the effect of the American demand was being felt, and the shipments for the quarter have only reached 74,446 tons, as against 96,137 tons, a decrease of 21,691 tons. Again, while the decrease of imports of Cleveland iron into Scotland has been 8,576 tons, there has been for consumption in Scotland not only the non-exported balance of Scotch make (the number of furnaces in blast having been pretty much about the same), but also a couple of cargoes imported from Nova Scotia. From Middlesbro', however, there has been considerable increase in the shipments during the quarter. Thus :—

Month.	Coastwise. Tons.	Foreign. Tons.	Total. Tons.
January ..	50,467	29,446	79,913
February ..	43,513	35,491	79,004
March ..	49,980	54,599	104,579

And the increase of "foreign" has been mainly in the shipments to Germany. How the quarter's shipments from the Tees compare with previous years may be seen in the following statement :—

January to March Shipments of Pig Iron from Middlesbro'.

Year.	Coastwise. Tons.	Foreign. Tons.	Total. Tons.
1898 ..	134,357	110,802	245,159
1899 ..	148,545	138,856	287,401
1900 ..	95,150	198,739	293,889
1901 ..	118,425	100,373	218,798
1902 ..	152,307	83,195	235,502
1903 ..	167,251	128,687	295,938
1904 ..	143,960	119,536	263,496

Thus the past quarter comes out fairly well, especially considering it had nothing to show against 51,160 tons shipped to America in the first quarter of last year. So far, then, the market for Cleveland iron has been well sustained by the external demand, for there are fewer furnaces in blast than in the corresponding portions of last year.

But, after all, there is really very little relation nowadays between the course of warrants and the trade demand for iron. Makers only adapt their quotations to the Warrant market when it suits them —and it does suit them at present. Although warrants have risen, as we have shown, the transactions in them have been few, and not large. The fact is that there are very few holders of warrants, and still fewer who are disposed to part with them just now. On the other hand, there has been a considerable "bear" account open in "futures" for some time, and it may be assumed that practically all the operations in warrants which have raised the price of late have been in the closing of "shorts." Those

who sold short when the prospect looked dark enough have been checkmated by the improvement reported in America and by the better conditions in Germany. A marked feature of the situation in the iron trade during the last few weeks has been the cessation of the German pressure to sell semi-manufactured steel and finished iron. This is interpreted to mean that the consumption has improved in Germany, but it may have other explanations. The German Steel Combine is said to be now about complete, and it is reported that the Combine is in negotiation with Belgian makers for a Belgo-German alliance to put an end to under-cutting in the protected markets on the Continent. The Hoop Iron Syndicate have raised the price of hoop iron, and the Sheet Combine are about to raise the price of sheets.

As to America, the advices are, overhead, of a revived demand for iron and steel, but there are one or two considerations to be kept in mind. The revival is not general, and the absence from the markets of the railroad companies, except in a few pressing cases of necessity, is a significant feature. The latter factor is possibly due to railmakers having refused to reduce their prices beneath $28 a ton. That the railroads will need a large quantity of rails this year is, however, unquestionable, though possibly not as large a quantity as last year. The production of pig-iron in America dropped very largely in the second half of last year, the total for the whole year was 18,009,252 tons, and not 20,000,000 tons as was predicted. But had the production of the first half been repeated in the second half, the total of the year would have been 19,500,000 tons. This year the production is being increased again. At the beginning of January the producing capacity was 195,558 tons per week; at the beginning of February it was 287,622 tons per week; at the beginning of March it was 318,223 tons per week. It has been further increased during March, and the April production is at a still higher rate. The output of February was 1,242,382 tons; that of March would be about 1,500,000 tons; and according to present appearances the whole production of 1904 may exceed that of 1903. As to whether the consuming capacity of the country will rise in proportion, opinions differ. The reports are certainly conflicting, but, unless the railway companies become large buyers again, we confess we do not see where there will be market in America for so much finished material as is represented in 18,000,000 to 19,000,000 tons of pig-iron; therefore, if that quantity of pig-iron is made, it is possible that a considerably larger quantity will be sent over here. In the meantime, however, there has been a pause in the selling of American pig-iron in England. The steel trade in Scotland is sustained largely by the agreement, miscalled a combine, among the Scotch manufacturers not to sell below certain mutually arranged prices in Scotland and in Ireland, though each is free to fight "for his own hand" in England. The associated makers are bound by heavy penalties to abide by this agreement; but it will cut both ways, and in the meantime it seems to be preparing a market for American and German steel.—*The Statist.*

ORDERS TO PLACE.

Wednesday, April 27th.

TOOLS AND STORES.—Miscellaneous tools and stores. Particulars (£1 1s.) from and tenders to C. W. Young, Secretary, East Indian Railway, Nicholas Lane, London, E.C.

Friday, April 29th.

STEEL PIPES AND SPECIALS.—2,800 tons of steel pipes and specials for the Port Elizabeth Municipality. Tenders to Davis and Soper, Agents of the Municipality, 54, St. Mary Axe, E.C.

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AT

BETHNAL GREEN GARDENS, N.E.

Persons desiring to submit tenders may inspect the drawing, and obtain the specification, bill of quantities, form of tender, and other particulars at the Parks Department, 11, Regent Street, S.W. Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with. The contractors will be bound by the contract to pay to all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule. Each tender is to be delivered at the County Hall, in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Wrought-iron Fencing, Bethnal Green Gardens."

No tender will be received after ten o'clock a.m. on Tuesday, the 26th day of April, 1904. Any tender which does not comply with the printed instructions for tender may be rejected.

The Council does not bind itself to accept the lowest or any tender, and it will not accept the tender of any person or firm who shall on any previous occasion have withdrawn a tender after the same had been opened unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.
County Hall, Spring Gardens, S.W.
April 12th, 1904.

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